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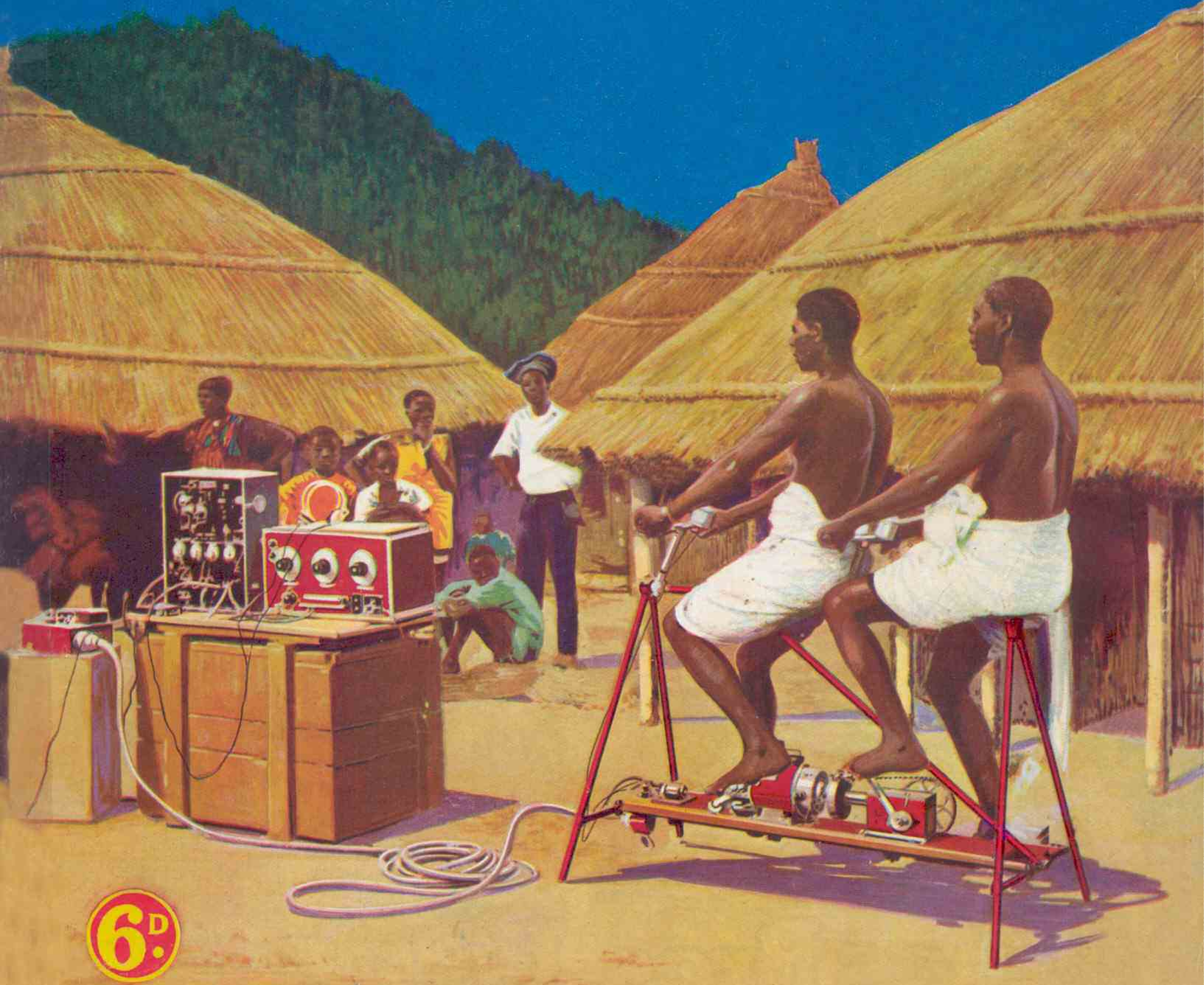

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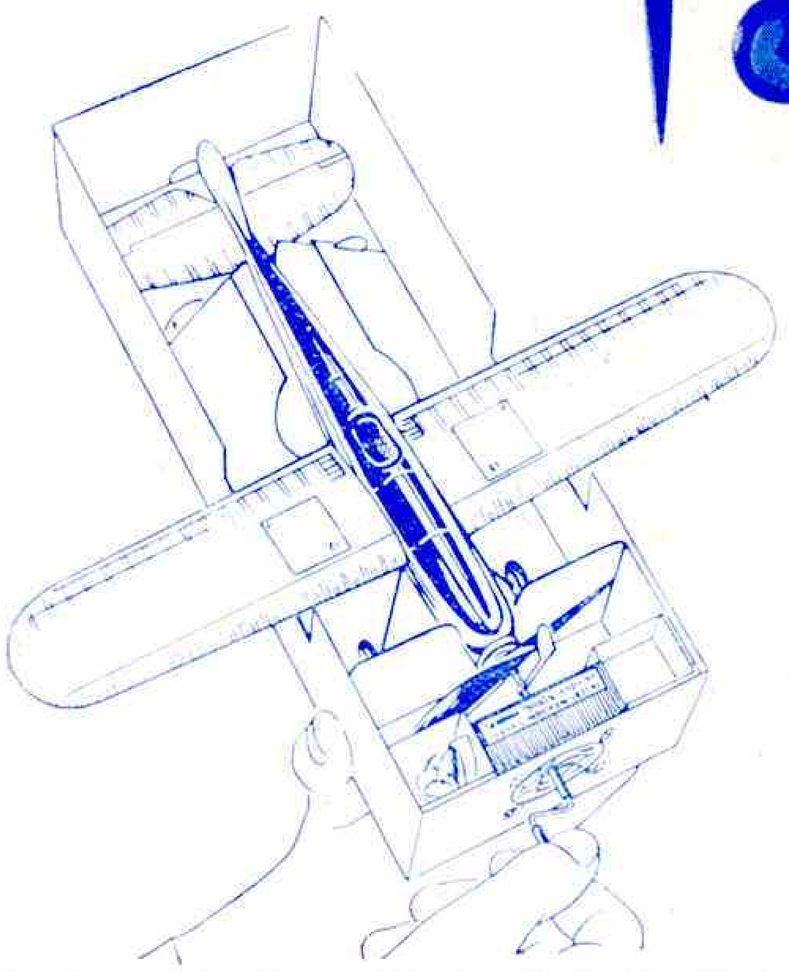

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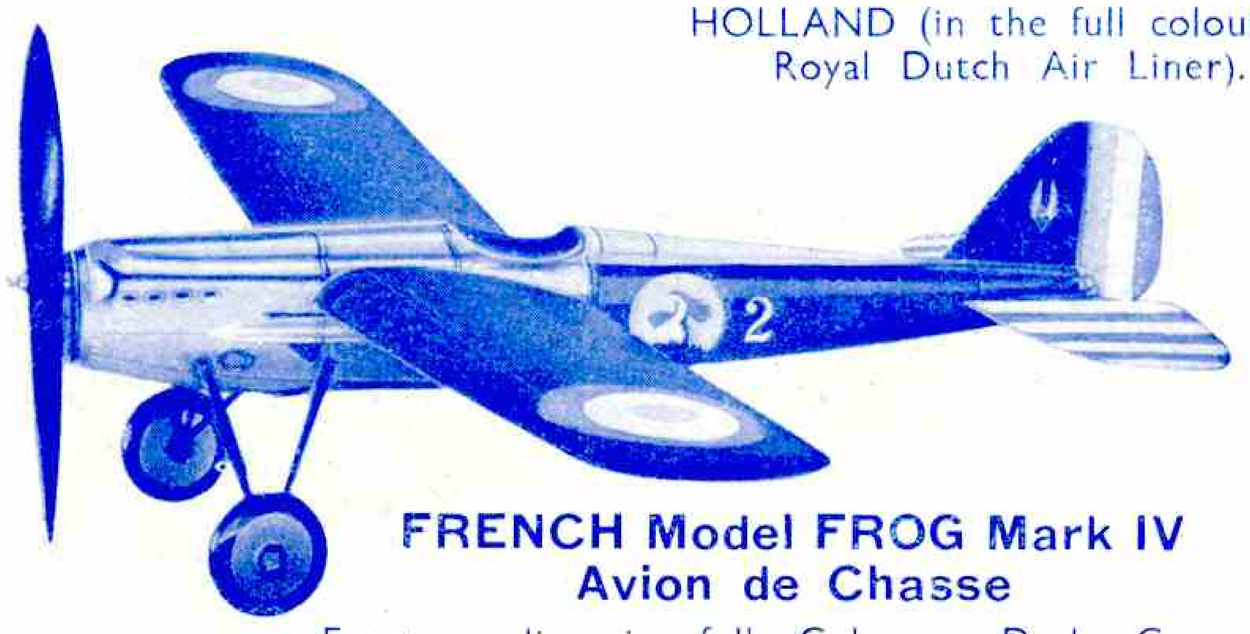

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With the Editor

The Great Wall of China

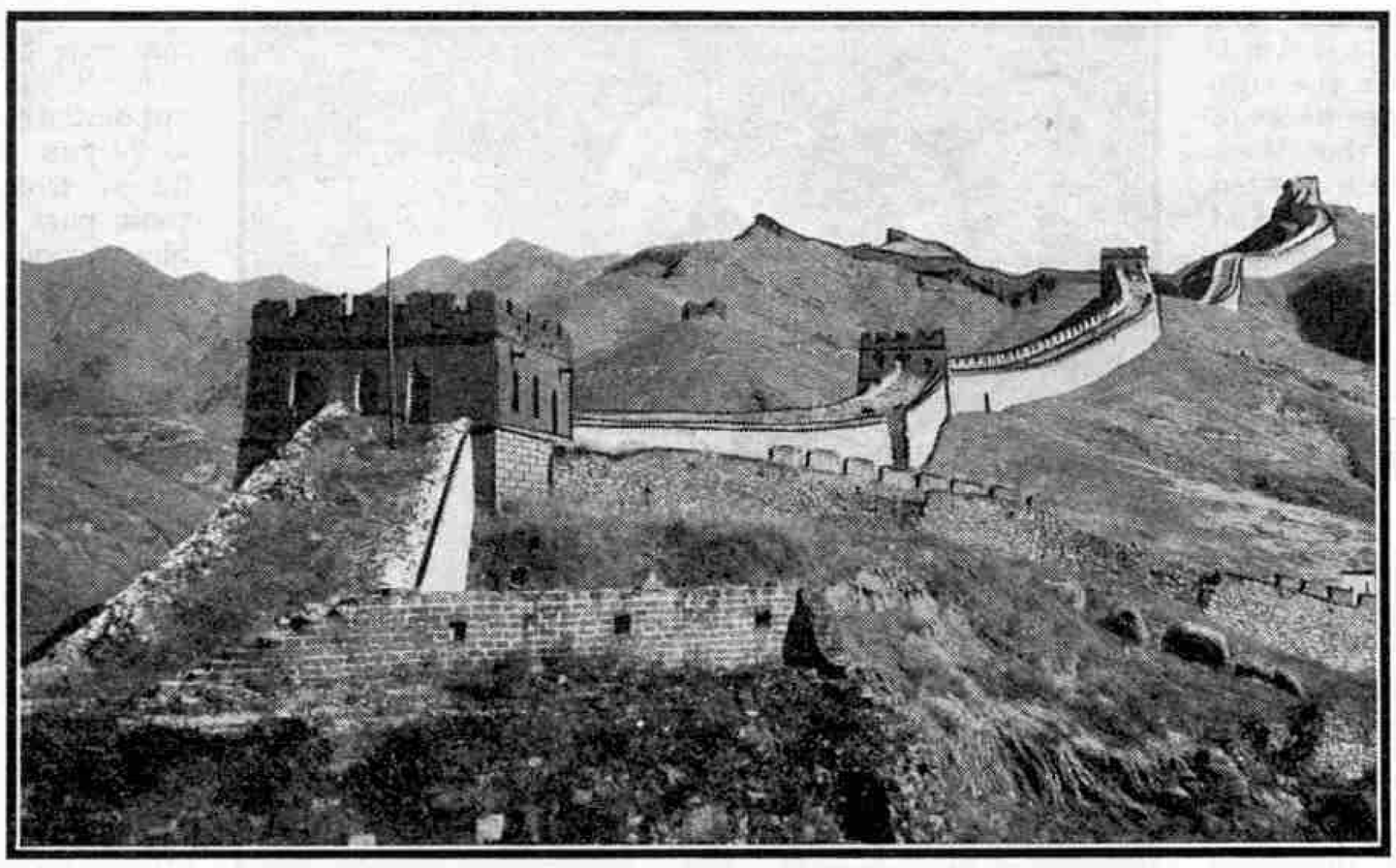
Recent events in the Far East have revived interest in what is undoubtedly one of the greatest engineering wonders of the world—the Great Wall of China. This stupendous structure was built more than 2,000 years ago, and its length from its starting point on the shores of the Yellow Sea to its termination in the wilds of Central Asia is more than 1,500 miles. It was built by order of the Emperor Shi-Hwang-ti, under whose personal supervision work was commenced in 214 B.C. This Emperor was a great reformer and, like most other reformers, he wanted to do everything at once. He became so impatient of the Chinese historians who were always writing about the "good old days" of feudal times that he ordered the destruction of every book referring to the history of the Empire!

The Great Wall was intended as a barrier against Tatar invaders, and is built of brick and stone on a massive scale. It is 30 ft. in thickness at the base and from 25 to 30 ft. in height, and every few hundred yards there rises a turret to almost twice the height of the wall itself. The top of the wall is practically a continuous roadway, so wide that two carriages can be driven abreast on it; and it has been suggested that the broken sections should be restored in order to form a road from the sea coasts into the heart of Asia. It is believed that this would not be an excessively costly project, for the greater part of the huge mass of brick and masonry is almost as fresh to-day as when it was built.

The most amazing feature of the Great Wall is the manner in which it was carried over every natural obstacle that lay along the line it was planned to follow. It climbs rugged and precipitous mountains, some of them 4,000 ft. in height, and plunges into deep ravines and gorges, to reappear on the opposite side and vanish again over the crests of the hills beyond. Many thousands of workmen must have been employed continuously in its erection, for we are told that it was built at the rate of 100 miles a year. According to the stories that have been handed down to us, every third man in the Empire was made to take part in the work, and those who did not show sufficient zeal and energy were punished by being built into the masonry of the wall itself!

It seems a pity that the vast energy expended in building this wall was so largely wasted. From the first the structure was practically useless as a barrier, and throughout the centuries conquering hordes of Mongols have broken through it repeatedly in order to ravage the interior of China. It is of course of no value whatever as a defence against a modern army. Nevertheless its gigantic remains are of great interest as evidence of the skill and industry of the Chinese constructiona engineers of more than 2,000 years ago.

The Great Wall of China is almost unique for the only other structure that can compare with it in any way is the Roman wall believed to have been built about 120 A.D. by the Emperor Hadrian from Wallsend to the Solway Firth. This was a very much smaller undertaking, its total length being only 73½ miles. It was a substantial structure, however, and it resembled the Chinese wall in having turrets erected at intervals to give the defenders an uninterrupted view along the front of the wall, and also in its disregard for natural obstacles. After crossing the lowlands between Wallsend and the moorlands it ran for miles along the tops of precipitous crags in country that is still wild and sparsely inhabited. There its remains are readily traceable, but owing largely to less favourable climatic conditions it has not been so well preserved as its Chinese counterpart.



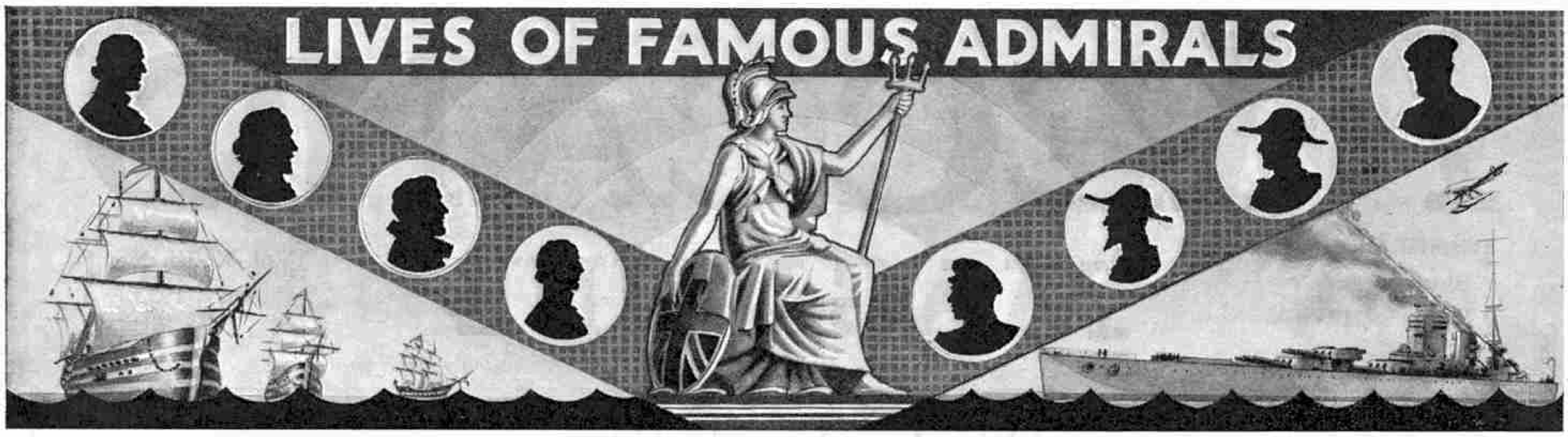
Part of the Great Wall of China, built more than 2,000 years ago to keep out Tatar invaders from the wilds of Central Asia who threatened to conquer the country.

The World's Ports

I have been very gratified to note the interest that has been aroused among my readers by the series of articles describing great ports. Ships and shipping are of unending interest to boys of all countries, and particularly of our own country, because of the wonderful record of British seamen in exploration and adventure afloat. The great work of our Merchant Navy would have been impossible but for the co-operation of the engineers who planned our ports and built the docks in which vessels great and small are loaded and unloaded, and repaired when necessary. These engineers must always look well ahead, for their docks must keep pace with the giants of the seas. For many years larger and yet larger vessels have been designed, and this has meant the construction of enormous new docks, and of graving and floating docks more than 1,000 ft. in length, large enough to accommodate the greatest ships afloat or planned.

In addition to their purely harbour and dock interest, most of the great ports of the world have specially fascinating histories, and the articles in this series are bringing home to readers the part that has been played in our national life by London, Liverpool, Glasgow, and other famous shipping centres.

Forthcoming articles will deal with the ports of Bristol, Southampton and Hull, and those of Tyneside, South Wales and Ireland. Subsequently the series will be extended to deal with the great ports of the British Empire—Capetown, Bombay, Singapore, Sydney, Montreal, Hong Kong, etc.—and finally will review a number of the most famous foreign ports, such as Hamburg, Rotterdam, and New York.



VI.—EDWARD BOSCAWEN

AT the time when Anson was making his memorable voyage round the world, another naval officer destined to become famous was beginning to attract attention by his daring deeds in battle. This was Edward Boscawen.

Boscawen was born on 19th August, 1711, and was the third son of the first Viscount Falmouth. The family was an old-established and wealthy one, with military traditions, and when the time came to consider a career two of the three sons chose to join the Army, and eventually became Generals. Edward early showed a fondness for ships and the sea, however, and in his 15th year he was sent aboard the "*Superbe*," of 60 guns, as a midshipman. He began his naval career on 3rd April, 1726, and a few days later the ship left England to join the fleet of Vice-Admiral Hosier in the West Indies. He served the allotted time of six years as a "middy" and was then promoted to Lieutenant, in which capacity he won for himself a reputation as a successful seaman and an active officer. His zeal brought him reward, and on 12th March, 1737, he was promoted to Captain and given command of the "*Leopard*," of 50 guns.

A year later Boscawen was transferred to the command of the 20-gun frigate "*Shoreham*" and sent to the West Indies, where, on the outbreak of war with Spain in 1739, he received orders to join an expedition commanded by Vice-Admiral Vernon and about to sail from Port Royal to attack Porto Bello. The "*Shoreham*" was then refitting, and as she could not be got ready in time, Boscawen sought and obtained permission to serve under Vernon as a volunteer. The attack on Porto Bello was successful, and afterwards he took part in the work of demolishing the forts.

In 1741 Boscawen resumed command of the "*Shoreham*" and the ship was added to Vernon's fleet for an attack on Cartagena. The town was found to be heavily fortified, and Boscawen was placed in command of a detachment totalling 500 soldiers and sailors detailed to storm a shore battery that was able to hinder seriously the landing of the expedition. Under cover of darkness the detachment landed safely about a mile from the battery and approached cautiously towards the battery. They were brought up suddenly by a hidden battery of five guns cunningly placed in anticipation of such an invasion, but they rushed the position and took possession of the guns. In the face of heavy fire they reached their objective and captured the main battery, which consisted of fifteen 24-pounder guns. They spiked the guns and set on fire the carriages, ammunition and guard-houses, and then returned safely to their ships. After further military operations Vernon raised the siege on Cartagena. Subsequently Boscawen again served under Vernon at Porto Bello, and on this occasion he commanded the "*Prince Frederick*," of 70 guns.

Portrait of Admiral Boscawen. The illustrations to this article are from prints in the possession of T. H. Parker Ltd., 28, Berkeley Square, London, by whose courtesy we are enabled to reproduce them.

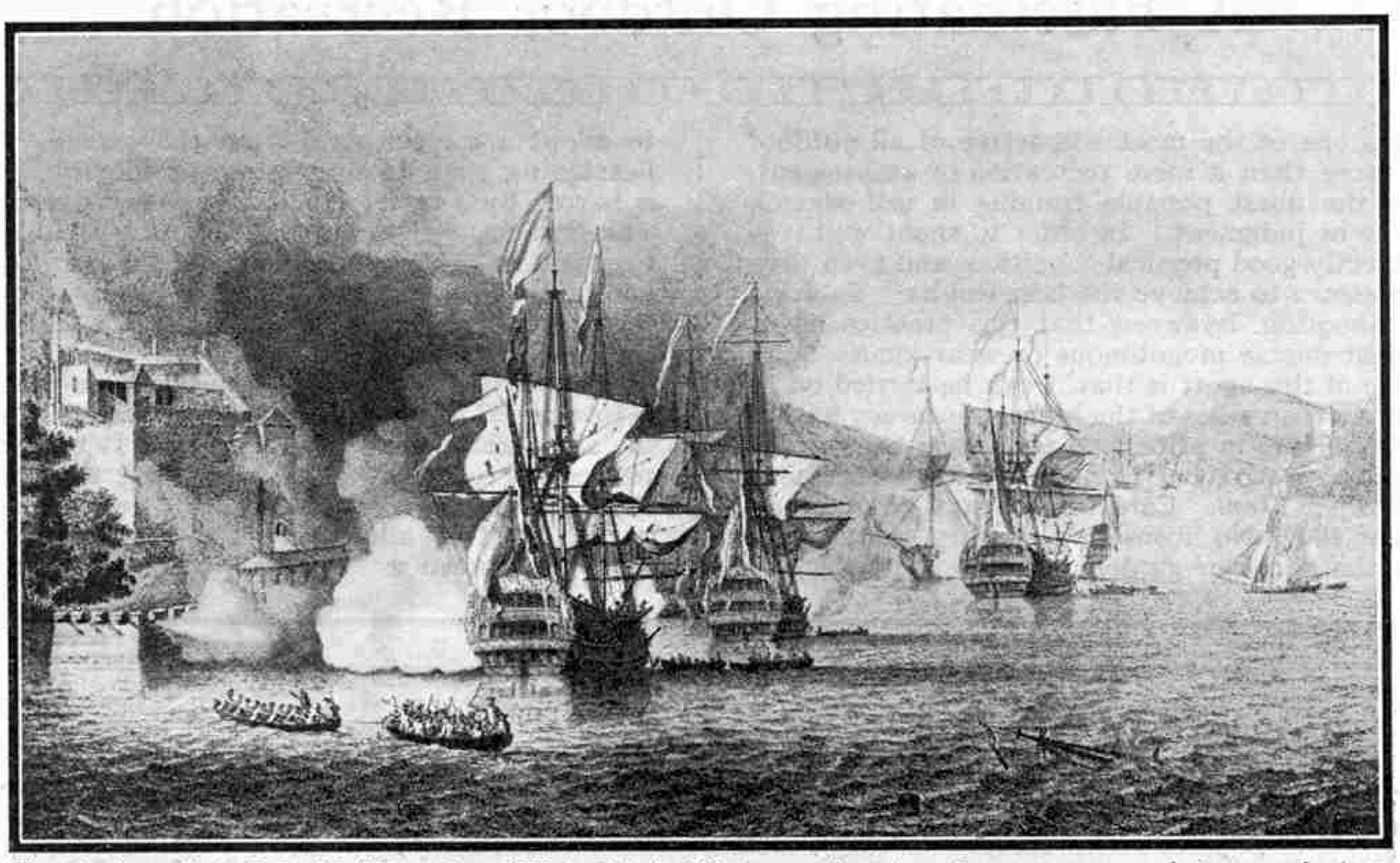
Boscawen returned to England in 1742 and shortly afterwards entered Parliament as a member for Truro. In the same year he was appointed to the "*Dreadnought*," of 60 guns, and until the beginning of 1745 most of his time was spent in this ship, cruising in the English Channel. While engaged on this service in April, 1744, with a fleet commanded by Admiral Sir Charles Hardy, he encountered the French frigate "*Medea*" of 26 guns, commanded by an officer named Hocquart; and after a chase and a sharp fight succeeded in capturing her. She was the first ship captured during the war with France. The courage he displayed on this occasion gained for him the nickname "*Old Dreadnought*," which stuck to him ever afterwards.

Early in 1746 Boscawen was appointed commander of the "*Namur*," a 74-gun ship that had been reduced from 90 guns, and in her took part in many naval exploits. She was one of the ships that formed Vice-Admiral Anson's squadron when he sailed from Plymouth on 9th April, 1747, to attack Cape Finisterre, and readers of our article on Anson will remember that he intercepted a large fleet of merchant ships bound from France to the East and West Indies and escorted by six sail of the line. The English fleet turned to westward so as to form in line abreast of the enemy, who kept up such a well-directed fire that Boscawen realised that the English ships would be disabled before their guns could be brought to bear on the French ships. The "*Namur*" was the leading ship of the van and Boscawen crowded on sail and moved swiftly forward, drawing upon his ship most of the enemy's fire until the English fleet's manœuvre was completed and it was able to come to his aid. During this heroic fight he was wounded in the shoulder by a musket ball. The engagement ended in the capture of the French escort and four of the merchant ships, and it is interesting to note that among the French officers taken prisoner was Hocquart, who thus for a second time fell into the hands of the English.

When Boscawen returned to England he was promoted to Rear-Admiral of the Blue, and shortly afterwards was appointed to the command of a powerful expedition to be sent to reduce Pondicherri, in the French East Indies. The expedition consisted of six sail of the line, and four smaller ships, and was accompanied by 11 ships of the East India Company. The personnel of the expedition included 1,500 troops. The expedition sailed from St. Helen's on 14th November, 1747, and after a voyage that was prolonged by much bad weather reached Madeira on 13th December of that year, and Table Bay at the Cape of Good Hope on 29th March, 1748. After a stay of five weeks, during which the troops were encamped ashore, the expedition resumed its long voyage on 8th May and steered for the coast of Coromandel,

which Boscawen was anxious to reach in time to act before the change of the monsoon in October. Off Mauritus the East India Company's ships parted from the fleet and steered for Batavia, while the fleet kept on its course and arrived at Fort St. David on 29th July. There Boscawen found a squadron under Admiral Griffin, who resigned the command to him and with a few of the ships returned to England. Boscawen's fleet, augmented by the remainder of Admiral Griffin's squadron, totalled 30 ships, which included 13 sail of the line, and formed the greatest naval force of a European nation ever seen in the Indian Ocean.

The troops and stores were landed at Fort St. David, and Boscawen led a land attack against Pondicherri while three ships of the line and one sloop bombarded the town from the sea. The combined assault failed, however, and a general bombardment by the fleet was then attempted, but shoal water made it impossible for many of the ships to approach close enough for their fire to be effective. Sickness developed among the troops, and when the heavy rains came on early in October Boscawen decided to raise the siege. Two days were spent in shipping guns, stores, etc., and the fleet then returned to Fort St. David. The English losses in this unsuccessful campaign totalled 1,065 men, while the French losses were only about 250. Soon after Boscawen returned to Fort St. David he received word that peace had been established between England and France, but he was ordered to remain in India until the French had signed the Treaty of Aix-la-Chapelle and carried out its stipulations, one of which was that Madras should become a British possession.



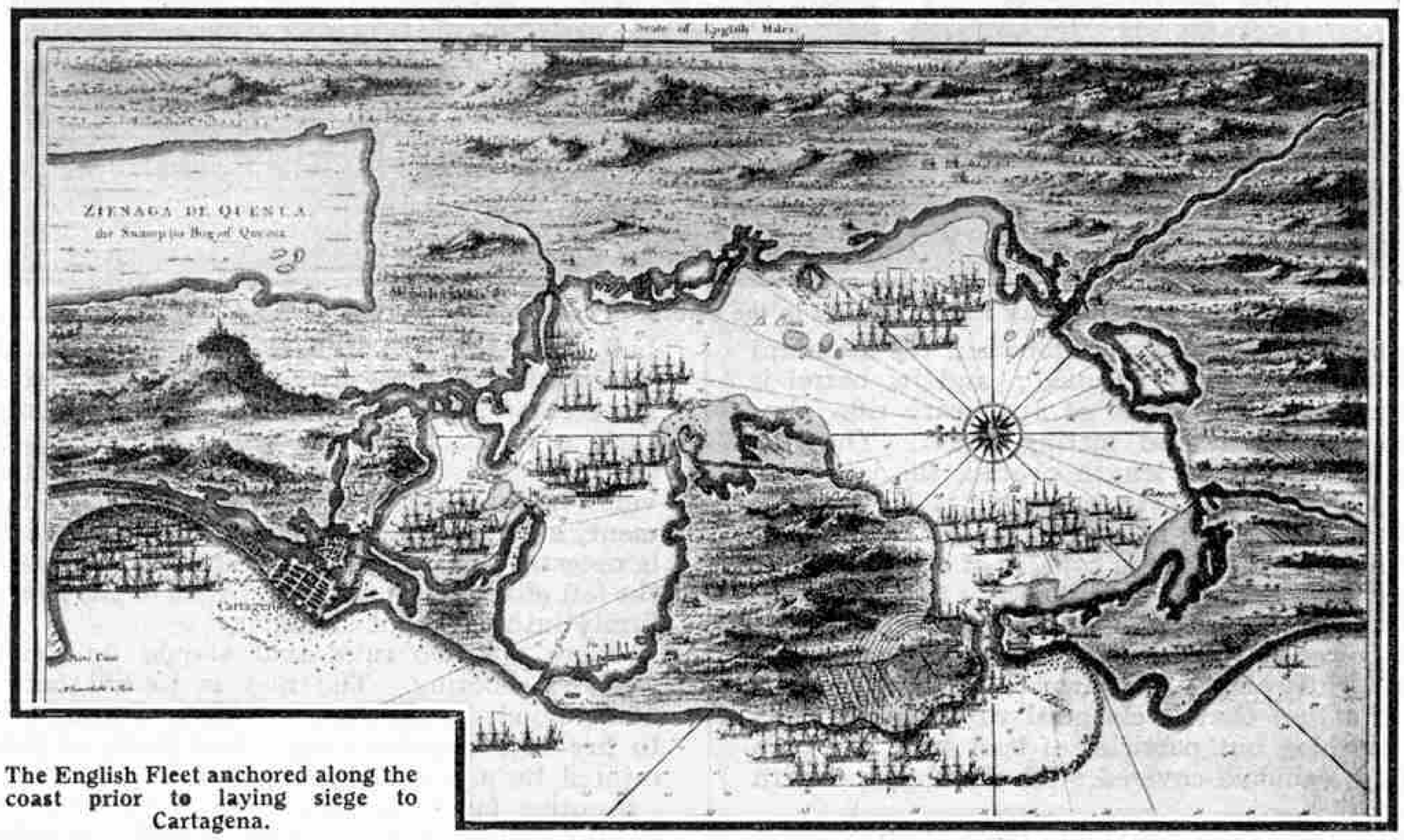
The attack on Porto Bello, 22nd November, 1739, by Admiral Vernon, under whom Boscawen was serving as a volunteer.

This delay proved unfortunate for Boscawen, as the "*Namur*" and the "*Pembroke*" were lost with nearly all hands during a hurricane. The flagship foundered in nine fathoms of water and the "*Pembroke*" was driven ashore and wrecked. Boscawen and some of his officers were ashore at the time. Madras was duly handed over to the English and Boscawen sailed for home on 19th October, 1749, and arrived at St. Helen's on 14th April, 1750.

In June 1751 he was appointed a Lord of the Admiralty, and shortly afterwards he was elected one of the Elder Brethren of Trinity House, the organisation that is responsible for maintaining the lighthouses and buoys around the coast. On 4th February, 1755, he was raised to the rank of Vice-Admiral of the Blue.

Relations between England and France again became strained and the threat of war reappeared. Boscawen was appointed to the command of a squadron of 11 sail of the line, two frigates and a sloop, and with two regiments of infantry on board he sailed on 27th February, 1755, from Plymouth for North America, under orders to intercept the French fleet as it sailed for the St. Lawrence River. He had only been gone a few days when news reached the Admiralty that the French fleet had left Brest for the same destination. Reinforcements consisting of six sail of the line and one frigate were hurriedly got ready and, commanded by Rear-Admiral Holbourne, sailed after Boscawen.

The two squadrons did not meet until both were on the other side of the Atlantic, however, and in the meantime Boscawen had encountered the French fleet. It was first sighted on 6th June off the Newfoundland coast, but was lost sight of in a dense fog and was not seen again until two days later, when Boscawen came upon three of the enemy ships that had become separated from the others. Although handicapped by the fog he succeeded in capturing two of these ships, the "*Lys*" and "*Alcide*," each of 64 guns, after an engagement that lasted five hours; and on board the "*Lys*" was found specie valued at £80,000 sterling. One can imagine Boscawen's surprise when he found that the commander of the "*Alcide*" was his old acquaintance Hocquart, who thus became a prisoner of the English for the third time! Boscawen met Holbourne off the Newfoundland coast on 21st June, 1755, and leaving him with a few ships to blockade the fortress of Louisburg, returned to England with the remainder of the fleet, the two prize ships, the booty and 1,500 prisoners. He received the thanks of Parliament for his successful exploit.



The English Fleet anchored along the coast prior to laying siege to Cartagena.

In 1756 he was promoted to Vice-Admiral of the White and shortly afterward to Vice-Admiral of the Red, and early in 1758 he became Admiral of the Blue. He was then appointed to the command of a large fleet equipped to co-operate with an army under General Amherst in North America in an attack upon Louisburg and Cape Breton. The fleet consisted of 41 sail of the line and 18 frigates, and carried on board 2,500 men commanded by General Wolfe, who later earned immortal fame as the hero of Quebec.

At Halifax, Nova Scotia, reached on 9th May, 1758, Boscawen was joined by General Amherst and an army of 12,000 men. The fleet, including transports, now totalled 157 sail, and leaving Halifax on 28th May it reached the Bay of Gabarus, seven miles west of Louisburg, five days later. There the troops were disembarked, and under General Amherst

(*Continued on page 388*)

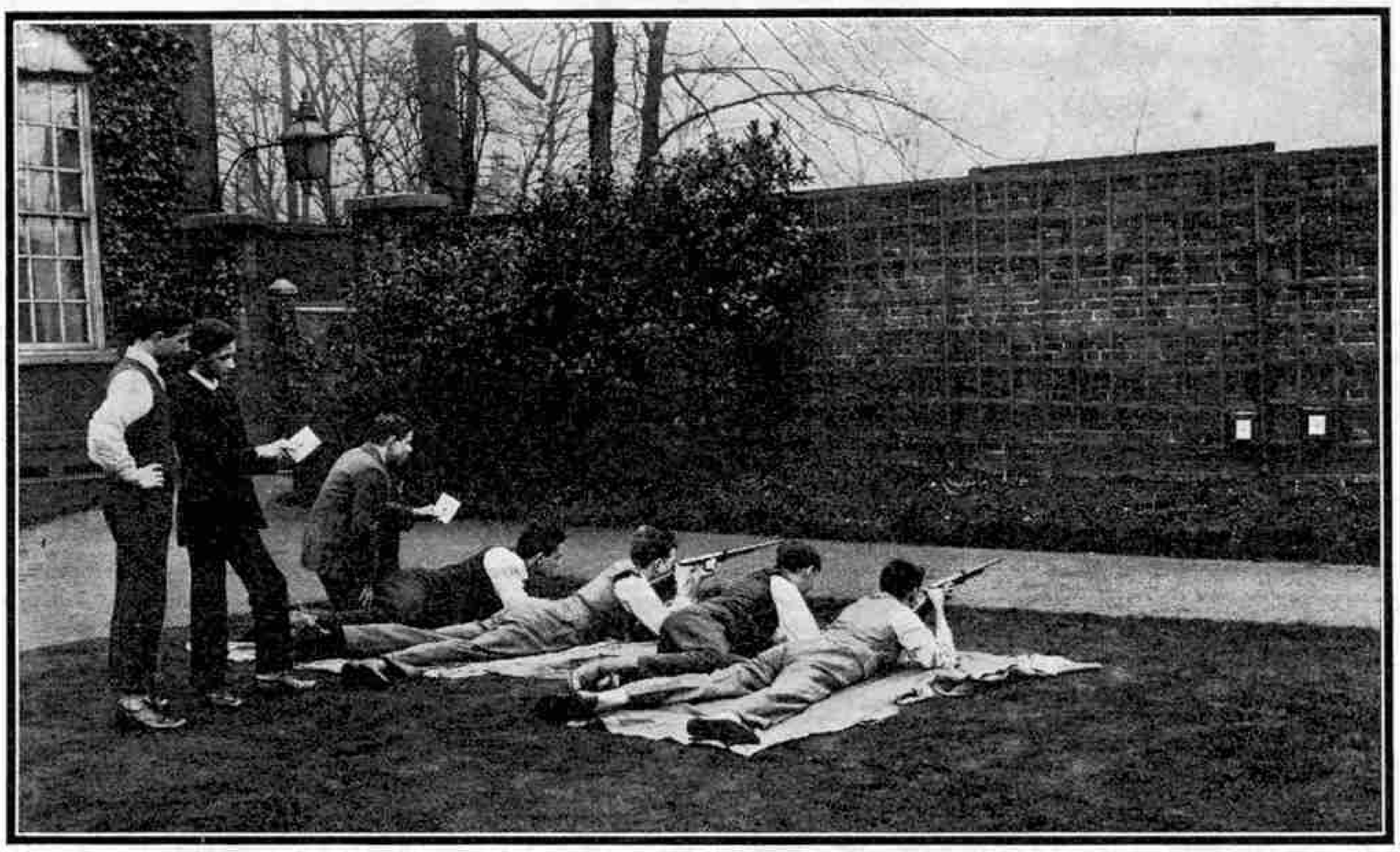
Shooting with an Air Rifle

A Fascinating Outdoor Recreation

AIR rifle shooting is one of the most attractive of all outdoor sports. It is more than a mere recreation or amusement, for it provides the finest possible training in self-control, restraint, and accuracy of judgment. In order to shoot well it is necessary to be in perfectly good physical condition, and even then regular practice is necessary to achieve the best results. So great is the fascination of shooting, however, that this practice never becomes in the slightest degree monotonous or wearisome.

One great advantage of this sport is that it can be carried on at a very small cost. Modern air rifles of the highest accuracy within their range are quite moderate in price, and they have the further great advantage of making use of cheap ammunition, the necessary pellets costing only 2/3 per 1,000. Card targets may be obtained for about a shilling per 100. No license is necessary to purchase or use an air rifle in the house or garden in Great Britain. We must emphasise, however, that a license is required for the use of an air rifle elsewhere than on one's own property.

An excellent example of an air rifle that will delight the heart of every boy who aspires to be a good shot is a new B.S.A. production that costs only £2/5/–. This is as powerful and as accurate as the more expensive standard B.S.A. air rifle, and its low cost has been made possible by substituting the "breaking" of the barrel for the use of a separate lever as a means of cocking the weapon. The new rifle is considerably lighter than the standard model, and is therefore more easily handled; and its barrel is rifled in the same manner as the barrel of a military rifle, thus ensuring absolute accuracy and hard hitting power. The rifle weighs 5 lb. 7 oz., and is 41½ in. in length overall, the length of barrel being 18½ in. The distance between sights is 15¼ in., and the length of stock from trigger 13¼ in. The bore is .177 in., and the effective range is 30 yds. The rifle is capable of driving pellets through ⅜ in. pinewood at a distance of 10 yds.



Shooting with an air rifle at a target in the garden. Photograph by courtesy of B.S.A. Ltd.

An air rifle requires comparatively little attention in order to maintain its original power and accuracy. All that is necessary is to keep the cylinder slightly oiled; the barrel does not require the scrupulous cleaning after use that is essential with the ordinary cartridge rifle. For cleaning out particles of lead from the bore there can be obtained a celluloid-covered steel cleaning rod with bristle brush and loop.

Even in a small garden splendid fun may be obtained by shooting at a target. Obviously this target must be backed with something sufficiently solid to stop the pellets. If a convenient wall is available, a simple and effective method is to attach targets to a piece of ½-in. board fixed to the wall. An alternative to the wall is a large wooden box filled with sand, the targets being tacked to the front of the box. Steel target holders that trap the pellets after they have passed through the target can be obtained, and there are more elaborate devices that automatically indicate when a "bull" has been scored. Whatever arrangement is adopted, it is absolutely essential that it should be impossible for any person to pass behind the target into a position of danger.

A boy who wishes to become a skilled marksman must endeavour to adopt a correct style from the outset. Nothing is more disheartening than to find after considerable practice that progress is barred by a certain fault that has become almost a fixed habit. The first necessity in target shooting is to give careful attention to position. The marksman should lie down obliquely to the line of fire in order that his left elbow may be brought well under the rifle for support while aiming. The legs should be kept apart, the heels down, and the feet still.

When a comfortable position has been taken up the next thing is to aim. The path traced out by a pellet in its passage through the air is not straight, but curved. It is therefore clear that aim cannot be taken by merely pointing the rifle at the target, for allowance must be made for this curve, or "trajectory" as it is called. This allowance is made automatically by means of what are known as "sights" fixed on the barrel.

In order to describe accurately any desired position on the bull of the target it is customary to regard this as being marked with the hour figures of a clock. Thus, when we speak of "six o'clock," we mean the point on the bull corresponding to the six o'clock position or the hour hand of a clock. In aiming at a target of the ordinary circular type the sights should be brought into line with this six o'clock position, and they are so adjusted that the pellets will pass through the centre of the bull when the rifle is held steadily in this position.

Although shooting at a target in the garden is great fun, even more excitement may be had from shooting rabbits, or vermin such as rats. There is a great difference between a fixed target and one that is swiftly moving, and practice of this kind provides valuable training in estimating speed and direction of movement, and in rapidly adjusting one's aim to suit conditions. It is necessary to take up a steady position and a good stance, with the left elbow well under the barrel of the rifle and the butt pressed firmly into the right shoulder.

There are two rules that should be strictly followed in this kind of shooting. The first is to kill only creatures that are fit for food, or that are distinctly vermin; the second is never to fire before making sure that there is nobody who might be injured by a badly-aimed pellet.

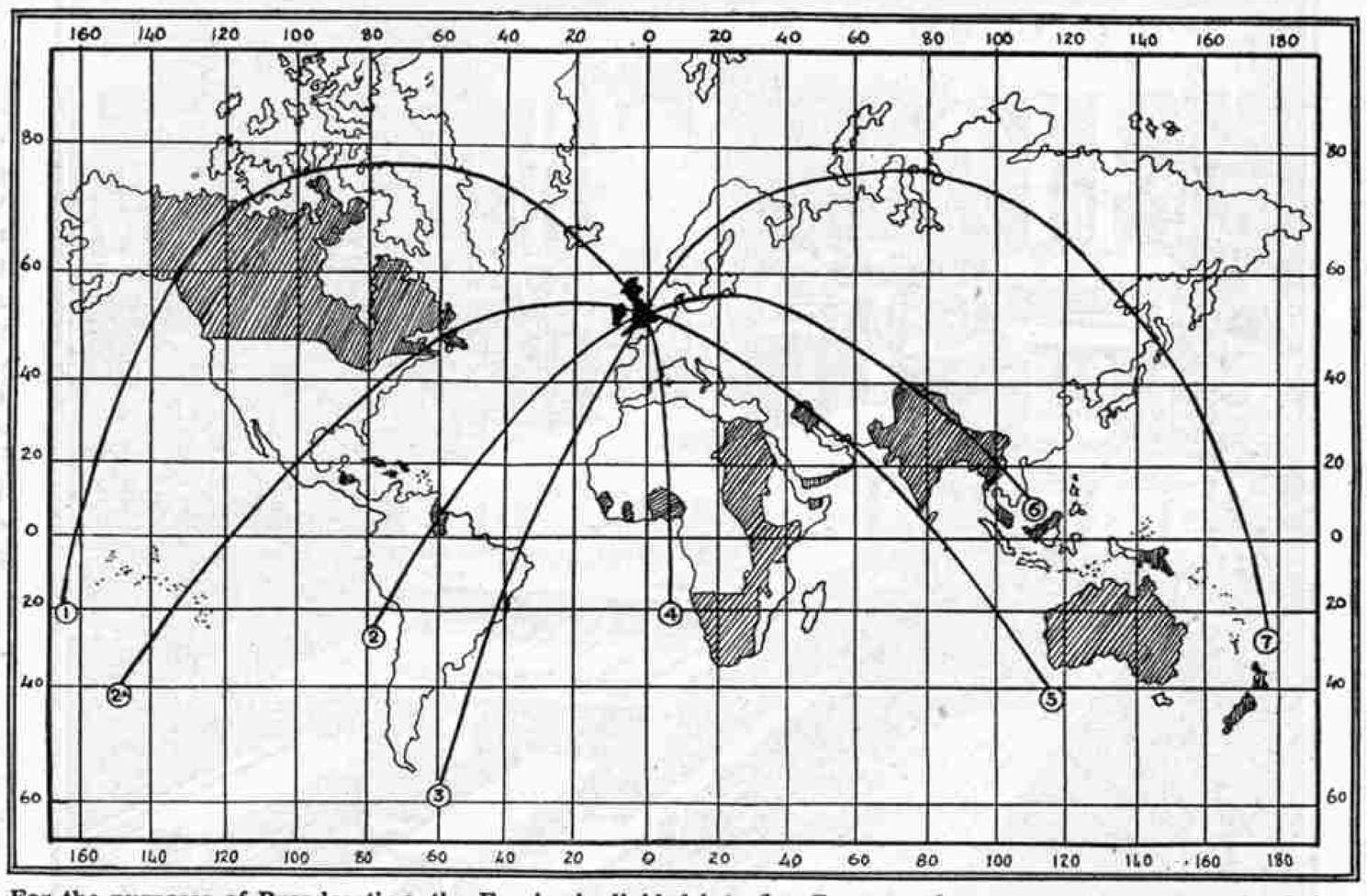
Another favourite pastime in many parts of the country is the shooting of wild wood pigeons with air rifles. These birds are notoriously cunning, however, and it is impossible to get within effective range by stalking them. The accepted method is to build a "hide" in a wood or plantation frequented by the birds (after first obtaining permission from the owner, of course) and to sit quietly in this until a fluttering in the branches of the trees above signals the return of several birds from their feeding grounds. Through a loophole or loopholes in the "hide" the position of the nearest birds is carefully observed and the gun brought into position with the minimum amount of movement. If the slightest sound is made in carrying out this operation the quarry will be away with incredible speed, and in all probability will not re-appear during the rest of the day.

A Radio Girdle Round the Earth

The Empire Broadcasting Service

OF all the places where we should least expect to find such modern marvels as a radio receiver and transmitter, that shown in our cover illustration this month is certainly one. The picture is reproduced from a photograph taken in Northern Rhodesia, and shows natives operating a pedal-driven generator for supplying electrical power to a Marconi portable radio installation that is capable of receiving and transmitting over considerable distances. Yet if twenty years ago these natives had been told that one day sounds produced many hundreds of miles away would be heard simultaneously in their own village, they certainly would have thought the prophet was a lunatic!

To-day the clang of "*Big Ben*" on the Thames Embankment reverberates not only in Rhodesia, but also in the remotest parts of the British Empire; and the lively rhythm of a modern dance band playing in a London hotel can be heard in the wilds of the African veldt, in the Indian bazaars, or in the heart of the Canadian Rockies. This marvellous development has been brought about by the inauguration of the British Empire Broadcast Service, operated by the British Broadcasting Corporation, which was introduced by the King on Christmas Day, 1932. On this momentous occasion His Majesty, speaking from his study at Sandringham, was able to send a personal Christmas message to his subjects in every part of the Empire, and millions of them heard the voice of their Sovereign for the first time.



For the purposes of Broadcasting, the Empire is divided into five Zones, and programmes are transmitted from London to each Zone at the following Greenwich Mean Times:—Zone 1 (between lines 5 and 7) 9.30 to 11.30 a.m. Zone 2 (between 5 and 6) 2.30 to 4.30 p.m. Zone 3 (between 4 and 5) 6.0 to 8.0 p.m. Zone 4 (between 3 and 4) 8.30 to 10.30 p.m. Zone 5 (between 1 and 2) 1.0 to 3.0 a.m.

A long period of research and experimental work was necessary before the Empire Broadcast Service could be brought into being, for owing to the immense distances to be covered, many technical problems not encountered in ordinary broadcasting had to be overcome. One great difficulty arose from the fact that time differs greatly between London and different parts of the Empire. For instance, a B.B.C. announcer speaking in London at 9 o'clock in the morning, may find it necessary to address his listeners in some distant part of the globe with "Good Evening Everybody!" It will be obvious therefore that it is necessary to transmit the Empire programmes throughout the full 24 hours, for the Empire is so scattered that there is always some part of it in which it is "listening-in" time.

The Empire programmes are sent out by two short wave transmitters, by the beam directional system, in order to concentrate the energy in one area instead of radiating it to all points.

For the purpose of broadcasting, the Empire is divided into five separate zones made up as follows. Zone 1, Australia, New Zealand, Hong Kong, Fiji and Pacific Islands; Zone 2, India, Burma, Malay States and Ceylon; Zone 3, Iraq, Sudan, East Africa, Malta and South Africa; Zone 4, West Africa, including Nigeria and Gold Coast, Atlantic Islands (Tristan da Cunha and Falkland Islands); Zone 5, Canada, West Indies, Trinidad, British Guiana and the Pacific Islands.

The five Zones have separate sets of transmitting aerials. Zone 1 is supplied by a single aerial operating on a 25 metre wavelength, and the transmission may be sent out in either direction, that is easterly or westerly, whichever proves to be the more suitable at the moment. Zone 2 has three aerials working on 17, 25 and 32 metres respectively; Zone 3 has two aerials working on 14 and 32 metres; Zone 4 has three aerials operating on 25, 32 and 48 metres, and Zone 5 has three aerials working on 19, 32 and 48 metres respectively.

The problem of providing a service of broadcast programmes that can be heard at convenient hours in each Zone is solved by broadcasting at various times from London. Generally speaking it may be assumed that the convenient listening period falls between the hours of 6 p.m. and midnight, local time, and the B.B.C. strive to provide a two-hour programme for each Zone somewhere between these times.

The majority of the programmes radiated by the Empire Station originate in London and reach Daventry via the control room at Broadcasting House, but programmes also can be taken from other centres, Birmingham, Manchester, etc., by means of the land lines that link the various centres.

The lines incoming to the Empire Station terminate in the main control room. This room contains the low-frequency amplifiers necessary to raise the programme to a suitable level for feeding to the two separate transmitters, and also switching apparatus for the distribution of the programmes to either of the transmitters. The control and checking or "monitoring" of the programme is carried out in this room. A second or subsidiary control room is provided for use in checking the input to the second transmitter. Both control rooms contain loudspeakers and headphones and are acoustically treated.

The two transmitters are arranged on each side of the main hall, while the power switchboard occupies one end. In the centre of the hall are two control desks, on which headphone points are provided to enable each engineer to listen to the programme that is being radiated by the transmitter he is controlling. Various indicators and emergency controls are also fitted to these desks.

The outgoing feeders from the power stage of each transmitter are connected to an aerial-changing panel fixed above it. On each panel is mounted a form of selector switchgear of special design, by means of which either of the transmitters can be connected to any one of the aerial systems.

Power is supplied to the station by the Northampton Electric Light and Power Company from their power station at Northampton, approximately 12 miles from Daventry. A sub-station on the Daventry site is fed from an 11,000-volt, 50-cycle, three-phase power line that is connected to the station mains by a 300 kVA transformer.

There are also 12 motor generators, which are divided into three groups, two of the three groups being used to supply the respective transmitters to which they are connected, while the third acts as a standby plant.

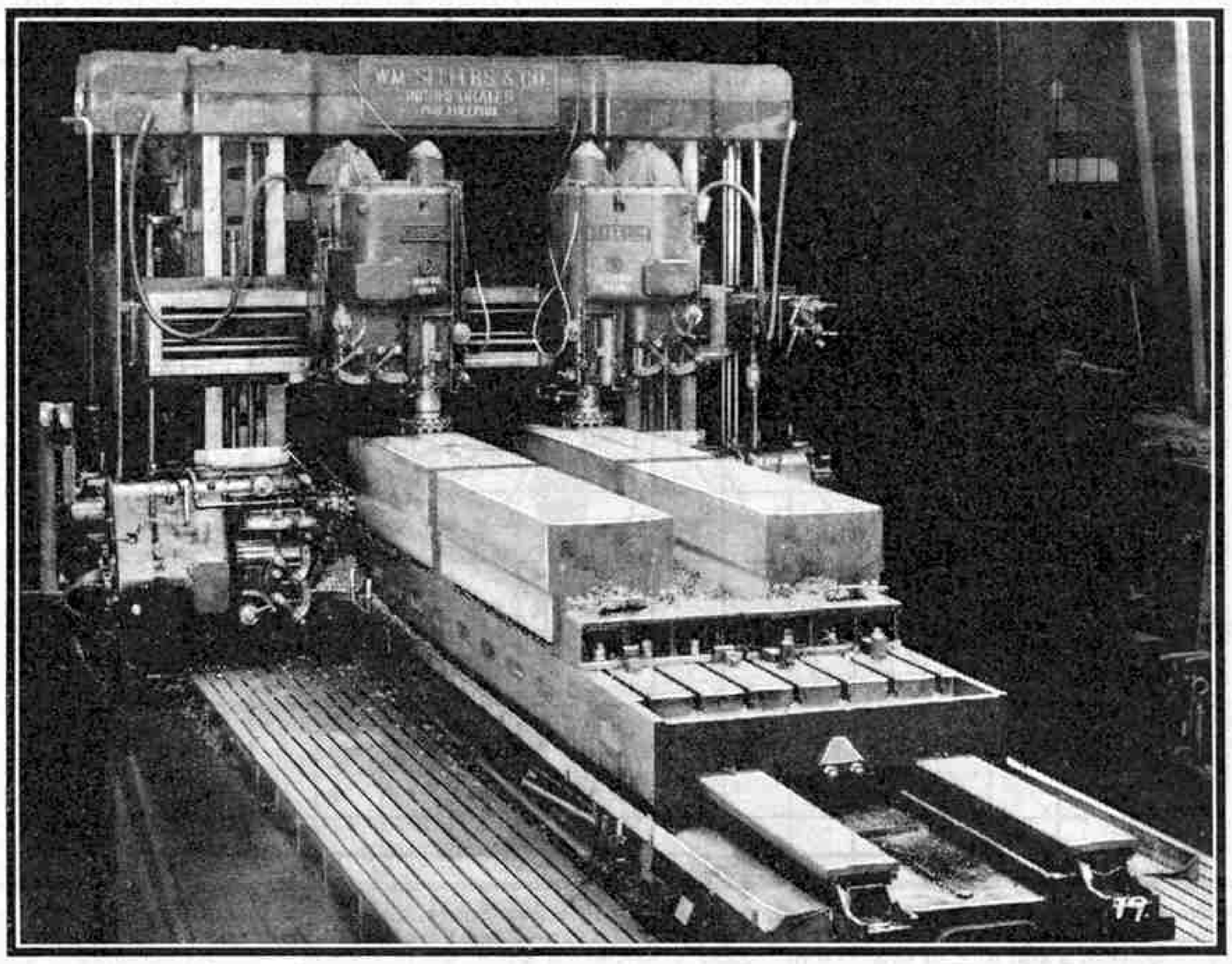
For the information and data on which this article and the accompanying map are based, we are indebted to the courtesy of the British Broadcasting Corporation, London.

New Planer-Type Milling Machine

Three Weeks' Work Done in Three Days

EVERY stage in the progress of Man from prehistoric days down to modern times has been marked by an improvement in his tools. Thousands of years ago he devised crude hand tools, such as stone hammers and flint scrapers, and these helped him to dominate the world, although himself inferior in speed and muscular strength to many of his rivals in the animal kingdom. Later he learned how to use fire to smelt metals and then made better tools and forged knives and other cutting instruments with sharper edges than those of his old flint instruments.

These improved tools gave Man greater command over the natural resources upon which he depended for existence, and their possession enabled him to devote more time to thought and development. Thus he was led on to the introduction of crude forms of machinery, of which the earliest lathes were the best examples. Machines of this kind were used in India centuries ago for shaping round pieces of wood and metal. The more primitive forms slowly developed into the simple foot lathe that may be seen even to-day in small workshops, and the invention of the steam engine transformed this into a machine tool. Henry Maudslay, the famous English engineer who may be regarded as the father of the precision machine tool, played a great part in this transformation, for he invented the slide-rest, or carriage travelling on the lathe, in which tools can be securely fixed instead of being held and guided by the craftsman. This led to greater accuracy in workmanship, for a tool fixed in a slide-rest is not so liable to slip as one in the hands of a workman; and also to a considerable saving in time. The growing use of power also contributed largely to a general speeding-up.



A Sellers planer-type milling machine at work. For the illustrations to this article we are indebted to the courtesy of Wm. Sellers & Co., Inc., Philadelphia.

The improvement of the lathe was followed by the introduction of the planing machine, by means of which true flat surfaces are produced. Before the invention of this machine in 1820, by Joseph Clement, such surfaces could be produced only by the costly process of hand-chipping and filing, but to-day surplus metal may be removed by means of straight steady strokes of a cutter that is under complete control.

The planing machine in turn was followed by screw-cutting and milling machines, and the invention of the electric motor provided a new and very convenient form of power unit. These machines were steadily improved, and new uses were found for them, with the result that modern engineering workshops carry wonderful machinery capable of performing tasks far beyond the powers of the individual human beings who brought the modern machine tool into existence. The degree of accuracy attained by means of these machines is remarkable, and as they work at very high speeds, complicated products that formerly required a series of operations extending over many weeks may now be turned out in a few days.

An excellent example of a modern tool for which there are many interesting applications of this kind is the planer-type milling machine manufactured by Wm. Sellars & Co., Inc., of Philadelphia. This is a machine with four milling cutters, mounted respectively on two vertical and two horizontal heads in order to enable work to be approached from different angles. These heads are movable and adjustable, and are carried on a gigantic framework in such a manner that work may be carried out on castings supported on a table or platform in exactly the same manner as in a planing machine.

The illustration on this page shows a Sellars planer-type milling machine at work. The machine is capable of dealing with work up to 5 ft. 4 in. in width and 5 ft. in depth, and the table is long enough to support castings 20 ft. in length. Three of the four milling cutters may be seen in the photograph. Two of the heads carrying them are mounted on a horizontal cross-rail, and on the left is shown one of the horizontal cutters carried on the massive uprights supporting the cross-rail. The fourth cutter, which is hidden by the steel being milled, is the second horizontal one, and is supported on the right-hand upright member of the framework.

Each head has its own motor, a 20 h.p. unit that drives the spindle carrying the milling cutter and also gives the head itself the appropriate horizontal or vertical traversing movement. The drive is transmitted through short shafts and spur gearing of hardened chrome-nickel steel, and ball or roller bearings are used throughout. The spindle is made from a heat-treated chrome-nickel forging and is 6 in. in diameter.

The circular milling cutters are 11 in. in diameter. As they cut into the metal they are fed towards it by means of independent motors, and the operator has this movement under complete control through a speed change box and rheostat. The stroke, or maximum distance over which this feeding action may extend, is 14 in. in a crosswise direction.

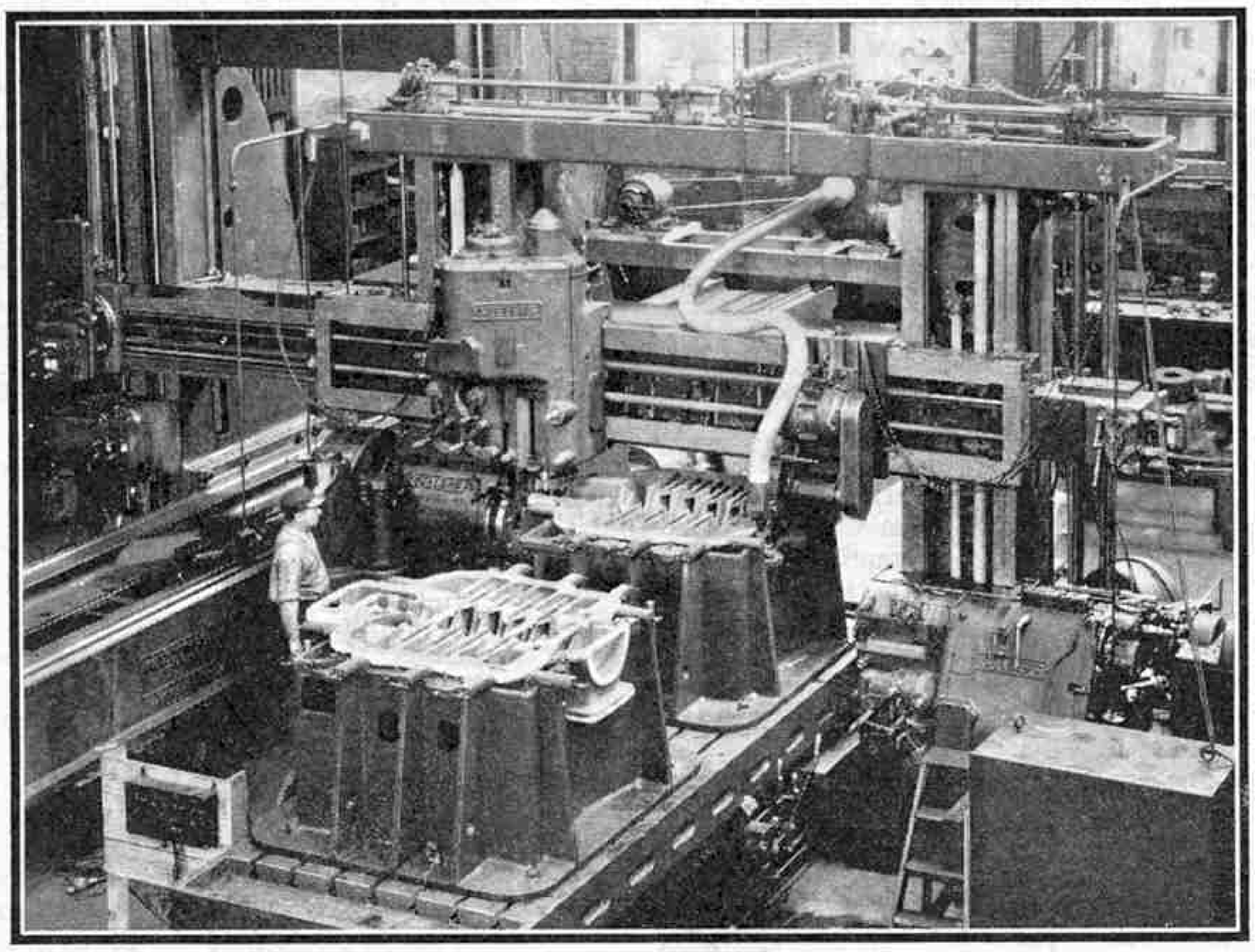
The horizontal table carrying the work is of deep box construction and slides on two rails, one of which is flat while the other has the shape of a double V. This type of support allows extreme accuracy of movement, and gives a bearing surface able to resist the heaviest sidethrusts that may be applied. Holding-down shoes are also provided in order to prevent the table from lifting during milling operations. The necessary movement under the cutters is given by a separate motor acting through spiral gear, and its speed is controlled by means of a change gear box and rheostat.

An important feature of the machine is that separate motors are used for the working units, the movements of the milling heads and the cross-rail and the feed of the cutters being independently controlled. In addition, milling cutters of different diameters may be used on the same job, and these may be driven at different speeds to suit the task to be carried out. A large variety of work therefore may be carried out with a single machine.

All the motors giving the various drives are controlled by means of push button switches mounted on duplicate panels, one on each side of the table. This is a convenient arrangement, for it is unnecessary for the operator to move from one side of the machine to the other when he wishes to start, stop or reverse any of the motors. Another valuable feature is that the controls are completely interlocked in order to prevent movements from being made in the wrong order. For example, it is impossible

to start the motors that feed the cutters into the work until those rotating the cutters themselves have been started. The many special safety devices incorporated include clutches that act as precautions against possible abuse; and overloading the cutter motors automatically causes these to be slowed down, or stops the feeding action.

Lubrication is a very important consideration in dealing with a complicated machine called upon to carry out heavy work, and elaborate arrangements have been made in order to ensure plentiful supplies of oil where necessary. Each milling head has its own pump for circulating oil, and an oil pump also is provided in the feed gear box. The ways or rails on which the table slides, the spiral driving gear and the many drive shaft bearings and gears are lubricated by means of a pump that automatically comes into operation before any movement of the table itself can take place.



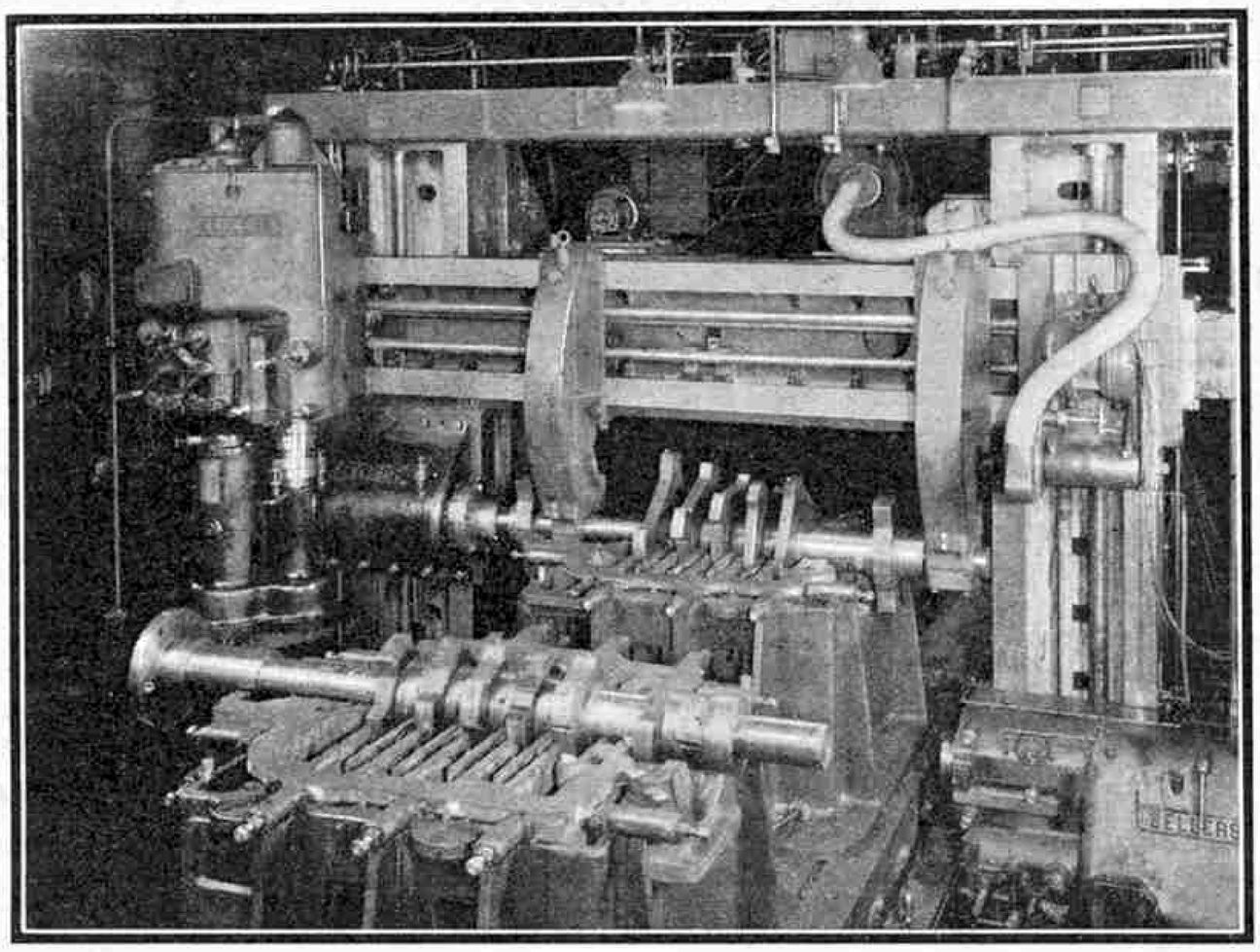
The two parts of a centrifugal pump casing on the table of a special Sellers planer-type milling machine equipped with boring and grinding heads in addition to milling cutters.

An instance of the manner in which the production costs of machinery may be reduced by means of a Sellers planer-type milling machine is shown by the experience of the Carrier Engineering Company, Newark, New Jersey, a firm that specialises in the building of refrigerating plant for supplying theatres and picture houses with cooled air. The central feature of the plant is the centrifugal compressor, or pump that compresses the gas used as the refrigerating agent. The casing of the pump is very intricate, and as previously made this consisted of 28 separate parts, on which no fewer than 44 machining operations were carried out. The introduction of a special Sellers milling machine enabled machining to be done in one set-up, the only other operation of this kind then required being a final reaming. By this means the time required for making the casing has been reduced from three or four weeks to three days of eight hours each!

When it became necessary to reorganise the manufacturing process, the design of the casing was closely studied, and it was found possible to cast it in two sections. These are now dealt with on a Sellers planer-type milling machine capable of taking work measuring 7 ft. by 6 ft. and having a table 18 ft. in length. The equipment of this machine varies slightly from that of the standard milling machine already dealt with, for it carries only two milling heads, a vertical one on the cross-rail and a horizontal one on the right. The remaining positions are occupied by a special grinding head on the cross-rail and a boring head carried on an extension of the cross-rail on the left. In spite of the special nature of the machine, it can be used for general milling work, for the two milling heads may be employed for a wide range of operations when not required for work on pump casings.

The upper illustration on this page shows the two sections of a pump casing set on the table of the machine in readiness for machining. Each is locked in a separate fixture and ordinary movements of the table bring them in turn to the desired point as required. Two milling cuts are first taken over the joint, cutters 12 in. or 16 in. in diameter mounted on the vertical milling head being employed to remove altogether a depth of $\frac{3}{16}$ in. of metal.

The next operation is of special interest, and its nature will be made clear on reference to the lower illustration on this page. It consists of boring out the stages of the centrifugal pump casing, a complicated task that is carried out by means of a special Davis boring bar. This bar is bolted to the face plate of the boring head on the left of the machine. As it is 7 ft. in length and weighs only a little less than a ton, it requires substantial bearings, and therefore it is supported by means of special outboard bearings fastened to the cross-rail, as shown in the illustration. The bar carries a number of discs, each corresponding to one of the stages in the pump, and on these discs, as well as on the bar itself, are carried the cutters necessary to bore and face the sections of the casing to the required depths. There are no fewer than 86 cutters on the bar, and any one of these may be removed for grinding purposes without disturbing the others. They are set in position by means of micrometer gauges, and a remarkable degree of accuracy in boring is attained with them. Most of the cuts are made within a thousandth of an inch of the required size, and the greatest deviation allowed in any part of the complicated boring is five thousandths of an inch.



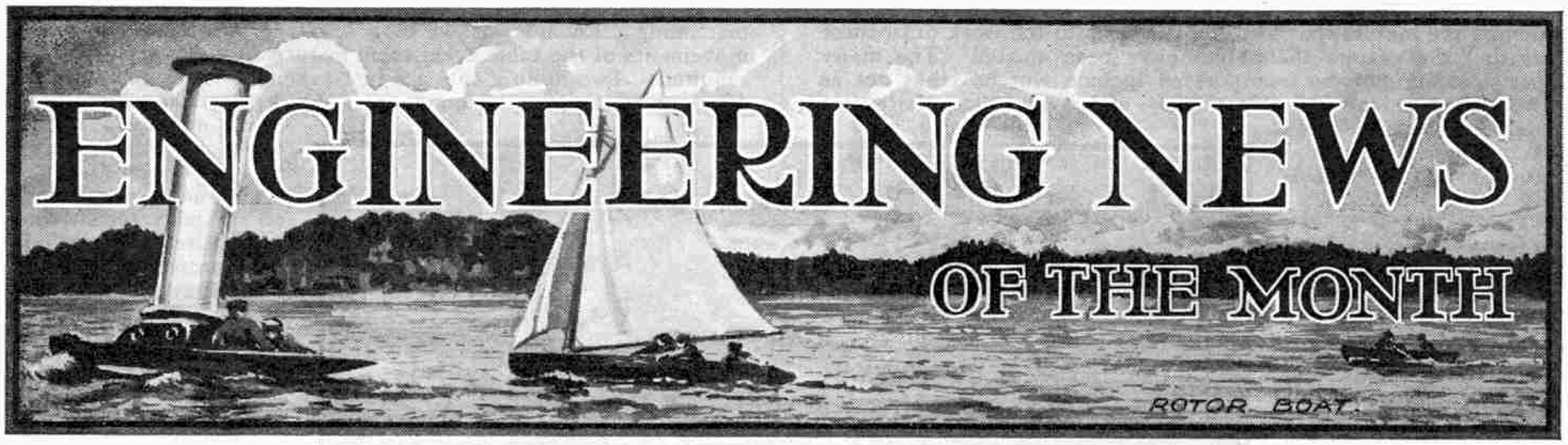
Boring out the stages of the pump-casing shown in the upper illustration on this page. The large surfaces are being bored and faced by means of a Davis boring bar, and in the foreground is the bar employed for cutting those of small diameter.

For the actual work two separate boring bars are employed, both being shown in the illustration. One of them is used for cutting and facing the surfaces of small diameter, the second operation, with the larger of the two bars, giving the surfaces of greater extent. The two bars are employed in exactly the same manner, but the larger one is rotated more slowly.

In the actual operation the table is traversed to a fixed stop in order to bring one of the castings into the exact position as required. There it is locked, and the boring bar set in motion. As it cuts through the metal, it is fed slowly and steadily along by a downward movement of the crosshead, and this is continued until the pump stages have been bored and faced to the limits required. During this operation the bearings for the shaft that passes through the finished compressor also are bored. The cross-rail is then raised in order to take the boring bar clear of the machine casing, and the table is unlocked and traversed to a second stop, thus bringing the second half-casing into position for boring out in exactly the same manner.

This completes the boring and facing operations on the two halves of the casings, and they are then ready for the grinding that is the final operation on this machine. For this purpose the grinding head already referred to is

(*Continued on page 388*)



Huge Mechanical Shovel

A large mechanical shovel has been built by Ransomes & Rapier Ltd., of Ipswich, in connection with a scheme for the production of Bessemer steel on a big scale at Corby in Northamptonshire. It is thought that the preliminary work at Corby will keep at least 1,000 men in constant employment for about a year, and British materials alone are being used. The shovel is to be used to remove earth, clay and limestone that lies to a depth of 50 ft. on the ironstone field. When this has been done the ironstone will be removed by small shovels. The big machine is 500 tons in weight and operates a bucket with a capacity of 9 cu. yd. It can dump a full load of material per minute at a radius of 100 ft. and at a height of 68 ft. The revolving superstructure is about 400 tons in weight, but in spite of this it can be turned through a complete circle in about 40 seconds. The speed of the machine can be estimated from the fact that a complete operation, consisting of lifting 11 tons of material 70 ft. and carrying it about 70 yd., can be performed in one minute.

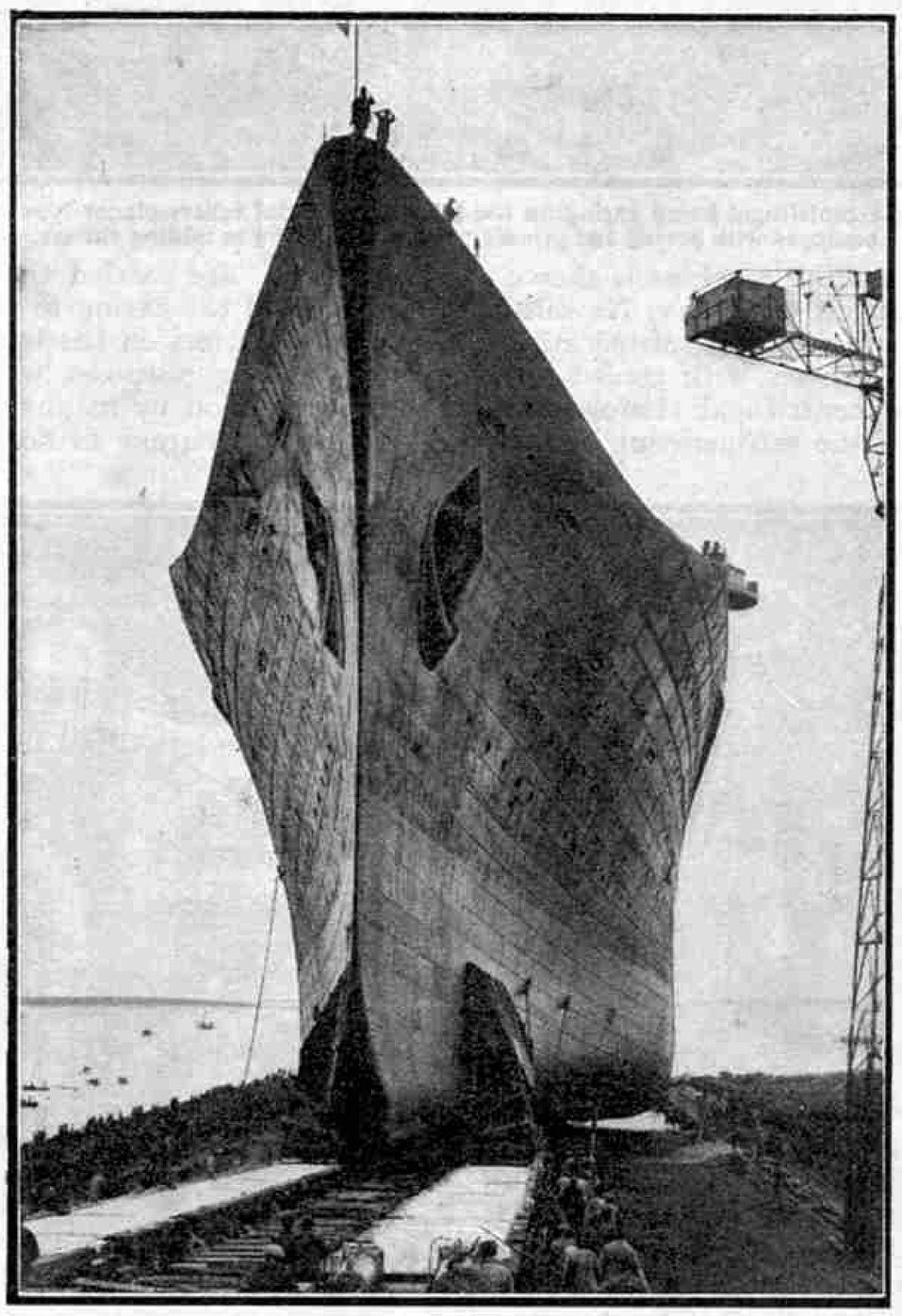
New High Tensile Structural Steel

An important advance in structural steelwork in this country is foreshadowed by the announcement of Dorman Long and Co. Ltd., of the production of a new and improved quality of structural steel that has been named "Chromador" steel. This is a high tensile steel suitable for all structural purposes, and it is claimed that it has at least 60 per cent. greater strength than the usual quality, with much greater resistance to corrosion. In spite of this the price is only 20 per cent. in excess of that of mild steel. The manufacturers have evolved this material as the result of nearly 10 years' continuous research that commenced with the production of a silicon high tensile steel for use in the Sydney Harbour bridge.

Interior Propeller for Tug

A tug built in Germany for service on rivers and inland waters is unusual in having its propeller inside the hull. The propeller is placed at the junction of three converging tunnels through which the water enters, two of the tunnels leading forward and to the sides of the vessel. The water passes out through the third tunnel in the rear, and the three tunnels together form a sort of "Y" shape. The tunnels have a maximum diameter at the outer end and taper to the centre, and the dimensions have been worked out so that the water flowing through the aft tunnel leaves the tug with a speed equal to that at which the vessel is moving along. This eliminates eddying and greatly increases the propulsive efficiency.

Among the advantages of constructing ships on this plan, which is known as the Kort system, are that efficiency may be increased without increasing the propeller diameter, and that a smaller tug is required for the same power. Another important feature is that the propeller can be coupled direct to the driving unit, with a consequent increase in efficiency, owing to the elimination of reduction gearing and the usual long shaft. The tug has a small draught and therefore is particularly suitable for service in shallow water, and the propeller is in no danger of being fouled.



The launch of the French liner, "Normandie," at St. Nazaire, showing the vessel just about to enter the water. A description of this ship was published on page 921 of our issue for December, 1932.

Fastest Submarine in the World

Britain now possesses the world's premier speed records, but another record recently acquired has gone almost unnoticed. This is the record for the world's fastest submarine, gained by the new submarine "*Thames*," constructed by Vickers-Armstrongs Ltd. The vessel is 345 ft. in length and 28 ft. in breadth, and her Diesel engines when developing 10,000 h.p. are capable of driving her at speeds of over 22½ knots. She displaces 2,165 tons on the surface, and 2,680 tons when submerged, and is the second largest submarine in the world, the largest being the British "X1." She is provided with a hull so strong that it is thought that she could dive to depths of 400 ft. without danger.

The "*Thames*" has oil tanks that would enable her to travel half-way round the world without refuelling, and she is specially fitted out to make her healthy and habitable when cruising in tropical waters. The safety equipment includes two escape hatches and a special telephone buoy that can be released from inside the vessel in case of emergency. The armament consists of a 4.7 in. gun carried in a revolving armoured hood, and six torpedo tubes of heavy calibre.

A particularly interesting feature of the vessel is the propulsion machinery, which has been produced as the result of co-operation between the Admiralty Engineering Laboratory and Vickers-Armstrongs Ltd. This consists of two 10-cylinder engines that operate at a speed of 405 r.p.m. at full power, and give the submarine a maximum speed on the surface equivalent to about 24 m.p.h.

The "*Queen of Bermuda*"

Trials of the 20,000-ton electrically-propelled liner "*Queen of Bermuda*" have been successfully completed. This vessel has been specially built by Vickers-Armstrongs Ltd., for the New York–Bermuda service of Furness Withy and Co. Ltd. Her propulsion machinery consists of two 7,500 k.w. Fraser-Chalmers-G.E.C. turbo-alternators that run at a speed of 3,000 r.p.m. and supply current to four 4,750 s.h.p. motors designed to operate at 250 r.p.m., and each coupled to a propeller shaft. The vessel is also provided with four 750 k.w. auxiliary generator sets, and steam is supplied by high-pressure Babcock and Wilcox water-tube boilers burning oil fuel under closed stokehold conditions.

A Paper Safety Gauge

Men at work on demolishing a tall chimney in Gelsenkirchen, Germany, literally depended for their lives on a sheet of paper. The men were making a hole in the bottom of the chimney in the customary manner, but instead of replacing each brick taken out by a wooden block that can afterwards be burned away when the men have retired to safety, the hole was left gaping and the operations were continued almost up to the time of the crash. In order to give warning when the chimney had reached the danger point, a sheet of paper was pasted on the inner wall of the stack opposite the point at which the men were working, and a tube also was inserted inside the chimney. It was thought that immediately the structure began to break down one of these two indicators would warn the workmen that it was time to get clear. As soon as a crack appeared in the paper, therefore, the men ceased work, and in less than a minute afterwards the chimney stack was in ruins. The advantage of this method of working is that it is much quicker than the firing process previously described. In England and America, however, the modern method is to drill holes in the base of the stack, charge them with explosive, and fire this electrically from a safe distance.

A Bridge with an Open Floor

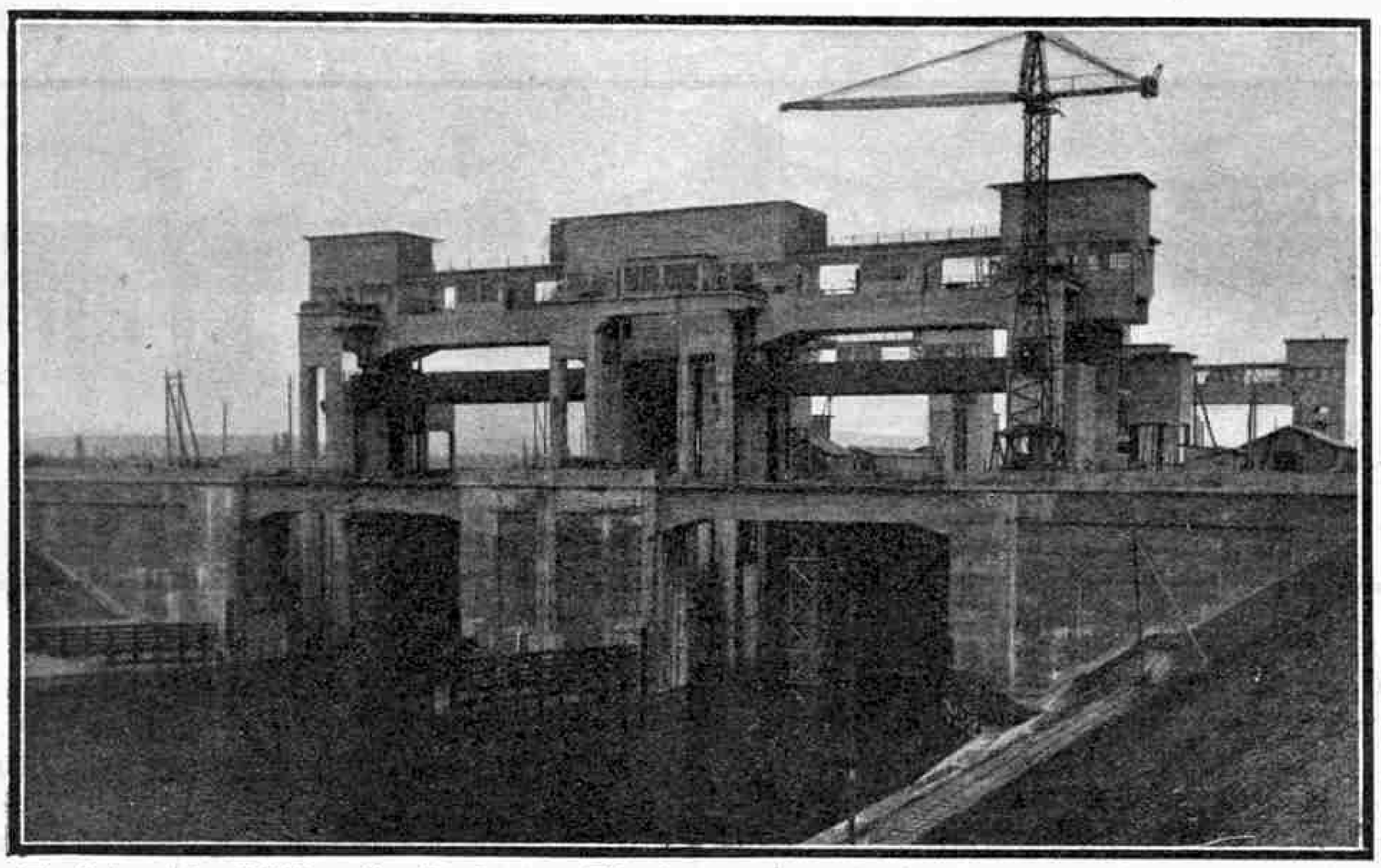
The extent to which motor traffic has replaced horse-drawn vehicles in many parts of America is illustrated by a bridge that has been built at Seattle, which is not provided with a floor in the normal way, but simply with two channels to take the wheels of motor cars. This method of construction was adopted in order to reduce the dead load of the bridge. The open construction renders it unnecessary to provide for snow and ice loads on the roads, and it allows a reduction in the wind load. This is believed to be the first highway ever provided with an open floor and has been built only after many experiments.

New Thames Bridges

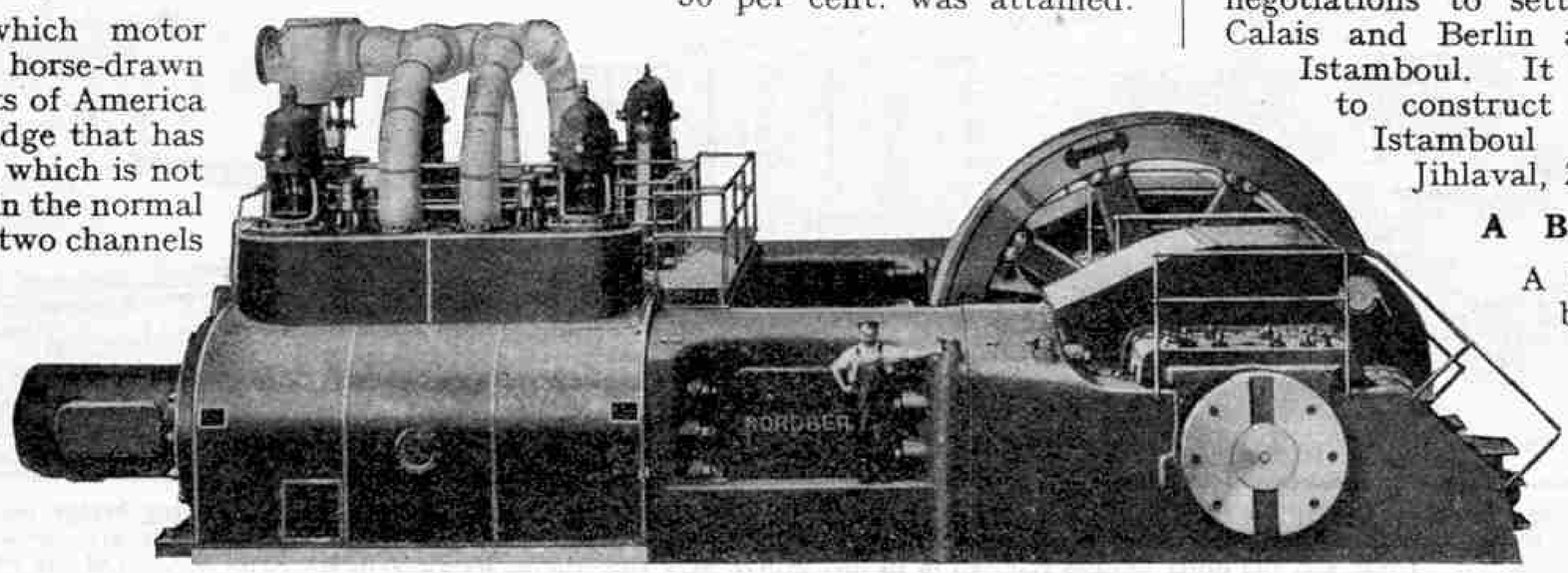
Three new Thames bridges, at Hampton Court, Twickenham and Chiswick respectively, should be ready for service shortly. It is hoped that it will be possible for all three to be formally opened on the same day, although construction on the bridge at Hampton Court has for some time been well in advance of the other two.

Electric Power in Korea

A hydro-electric power project that has been completed on the Fusenko River, in Korea, provides for the generation of 200,000 h.p. The river has been dammed to provide storage for 25,000,000,000 cu. ft. of water, and a pressure tunnel 17 miles in length leads the water to a storage chamber on the side of a mountain range. From there a pressure pipe carries it to the power station, which is equipped with four Pelton horizontal single wheel turbines with two nozzles coupled direct to the generators, and operating under a head of 2,180 ft. During a number of test runs of the plant that were carried out by official inspectors, it was found that a maximum efficiency of more than 90 per cent. was attained.



The "Grand Canal d'Alsace" at Strasbourg. This photograph shows the two big sluice gates, looking upstream.



The largest single-engined horizontal steam engine in the world. This engine, which is installed in an American metallurgical works, develops 16,000 h.p.

A Leyland Heavy Oil Engine

A heavy oil engine, suitable for use as an alternative to their petrol engines, has been produced by Leyland Motors Ltd. This engine is of the overhead valve type, and has six cylinders with a bore and stroke of $4\frac{3}{4}$ in. and $5\frac{1}{2}$ in. respectively. It is rated at 45.7 h.p., but develops 88 b.h.p. at 1,800 r.p.m.

* * * *

A dam in Western Australia is being provided with a roof 17 acres in area in order to prevent evaporation. When finished the roof will have the largest span in the southern hemisphere.

Canals Turned Into Tramways

A scheme for utilising a disused boat canal has been put into operation at Cincinatti, U.S.A., where a canal has been turned into cuttings for underground tramway lines, in order to relieve street traffic congestion. The roof over the tramway has been used to form a new thoroughfare. A line about six miles in length has been built, partly in tunnel and partly in open cuttings, the tunnel portion being provided with a concrete floor and a concrete slab roof supported on transverse roof beams of rolled steel. The street above is about 60 ft. in width without footwalks.

At Dayton and Syracuse other abandoned canals have been pressed into service to carry railway lines, in order to improve railway facilities in the business districts.

New Motor Roads on the Continent

A scheme that provides for the construction of a network of long-distance motor roads all over Europe is now making rapid progress, and the route of the roads connecting Berlin, Prague and Vienna has been decided upon by the various automobile clubs concerned. The great Berlin road will pass through Tabor, Sobieskay, Neuhaus, Neubistritz, Waidhofen, Goepfritz and Vienna, and construction is expected to begin very soon. The responsible authorities are now conducting negotiations to settle a route between Calais and Berlin and from Berlin to Istamboul. It is hoped eventually to construct a direct route to Istamboul through Prague, Jihlaval, Znaim and Vienna.

A Breakwater on Stilts

A breakwater that has been constructed in Lake Zurich is unusual on account of the fact that the actual reinforced concrete structure is only 18 ft. in depth, while in some parts in the region of the breakwater the bed of the lake is more than 90 ft. below the surface of the water. The reinforced concrete section of the structure is supported on long piles, some of which are 85 ft. in length. The concrete prevents waves from dashing into the harbour, and the use of piles has greatly facilitated the work of construction, in addition to being more economical than building a solid structure.

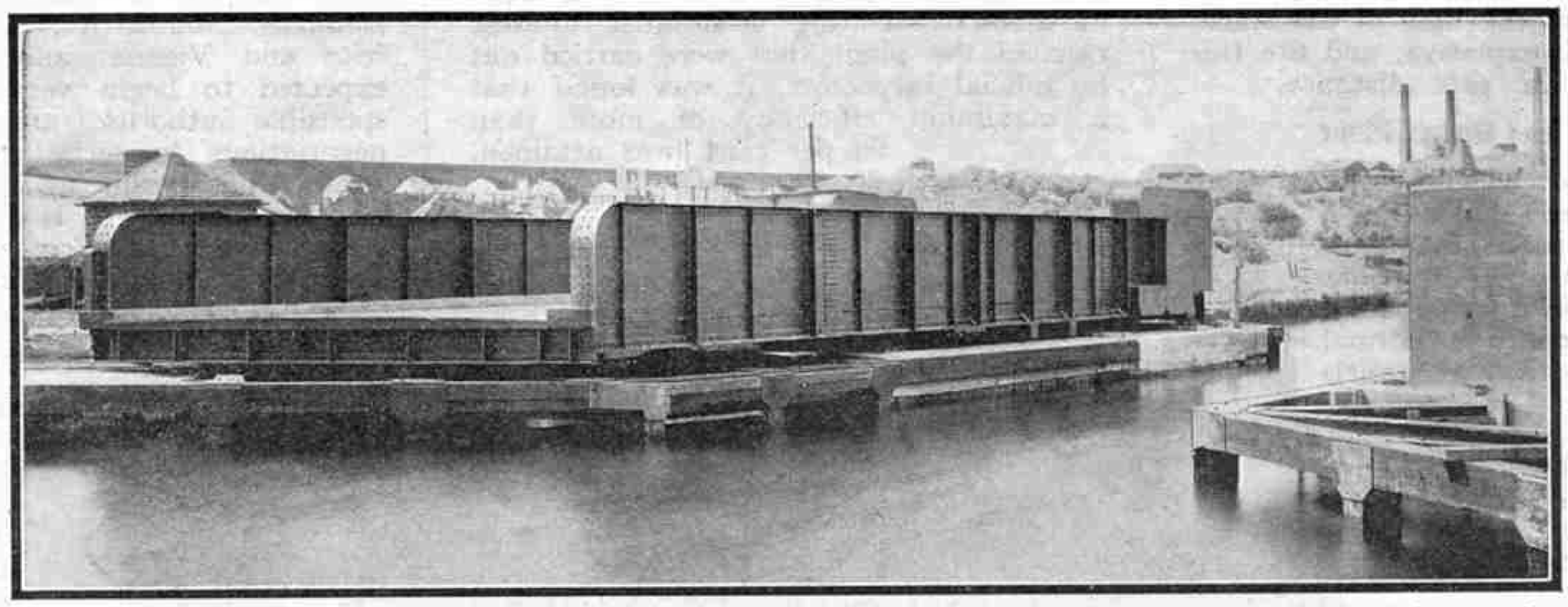
* * * *

Plans are now being prepared for a new bridge across the Danube to unite the countries of Roumania and Yugoslavia. Full details are not yet available but the bridge will carry a railway.

Modern Types of Opening Bridges

II.—The Swing Bridge

IN the first of the series of articles on "Modern Types of Opening Bridges," which appeared in our issue for July last, we dealt with the drawbridge or bascule type with opening leaves turning about a horizontal axis, the most famous example of which is the Tower Bridge, London. This month we deal with swing bridges that turn about a vertical axis, the weight of the moving span being carried on a turntable. This turntable may be placed symmetrically at the centre of the bridge, or unsymmetrically, so that the two arms are of unequal length. Generally speaking the live ring of the turntable contains a series of conical steel rollers turning on radial axles and moving round a circular roller path. An upper inverted roller path travels on the rollers in a similar manner, and carries the main girders of the swinging portion of the bridge. As a rule the opening is spanned by a single arm, but in some cases there are two swinging arms that meet in the centre. A very wide opening may be divided into two sections spanned by a swinging arm turning on a central tower between the two openings. Small swing bridges may be operated by manual power, but as a rule hydraulic or electric power is employed.

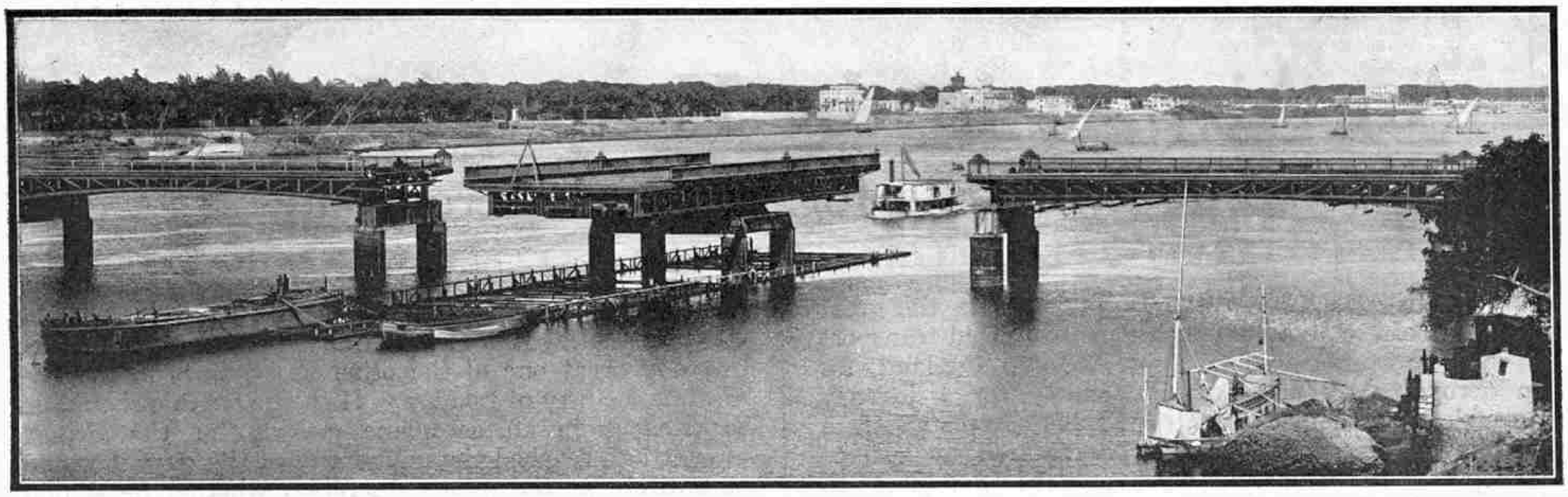


The upper photograph is of the railway viaduct over the River Barrow, Waterford, Irish Free State, showing the swing bridge portion closed to river traffic. The lower photograph shows the road swing bridge over the Forth and Clyde Canal at Castlecary, opened to canal traffic. These and the other bridges referred to in this article were constructed by Sir William Arrol & Co. Ltd., to whom we are indebted for our illustrations.

Our first illustration shows a viaduct crossing the River Barrow on the railway between Rosslare on the Wexford coast and Waterford, in the Irish Free State. The Barrow is a broad river with a relatively narrow navigable channel of great depth, 39 ft. 9 in. at low water on the Kilkenny side. The bridge is 2,131 ft. in length between the faces of the abutments, and consists of 13 fixed spans, each of 140 ft. clear width between the cylinder piers, and an equal-armed swing span having two clear openings of 80 ft. for the river traffic on each side of the centre dolphin. The bridge is crossed by a single line of railway of 5 ft. 3 in. gauge.

Interest in the construction of this bridge was largely centred in the piers, as several of these had to be sunk to a great depth, the maximum being 117 ft. below high-water level. A temporary staging was constructed across the river to provide access to the various positions where the cylinder foundations were to be sunk, a gap being left for the passage of river traffic. There was no suitable access to the site by either road or rail, and all material had to be brought by sea, which involved the construction of a timber jetty at right-angles to the staging for discharging the vessels. The cylinders and bridgework were manufactured in Glasgow and sent to the site by boats under special charter, and were discharged and stored on the staging. There was no living accommodation in the neighbourhood, and wooden sleeping bothies and canteens were erected and placed in the charge of caretakers, who prepared food and attended to the workmen.

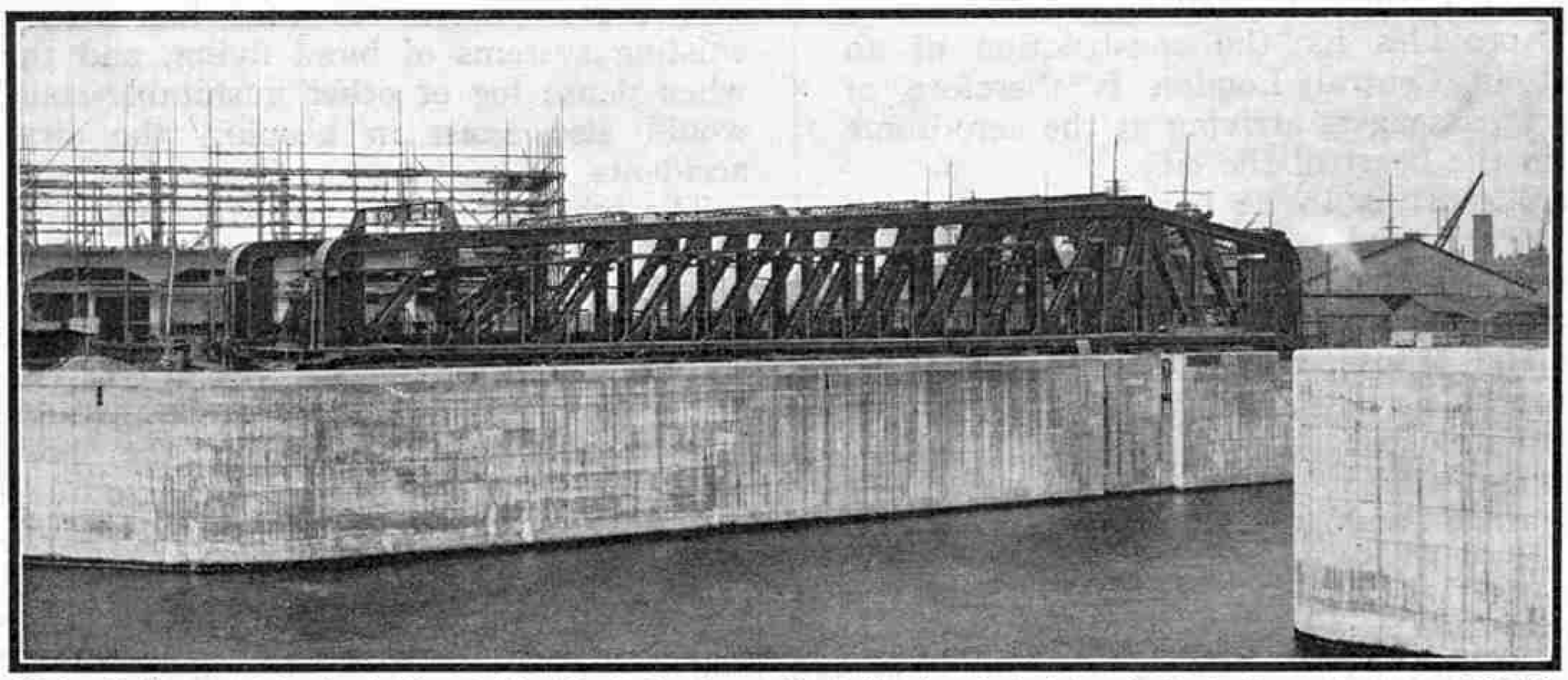
The staging consisted of timber piles spaced about 16 ft. apart, carrying crossheads to support a continuous deck and a crane track about 4 ft. above high-water level. The staging was mostly 15 ft. in width, widened out at the piers. The underside of the main girders was about 15 ft. above the staging, and these girders were erected on timber trestles placed under each



View of the road bridge across the Nile from Ghizeh to the island of Rodah. The swing portion is operated electrically and can be opened or closed in three minutes.

panel point and supported on the staging. As each span was completed the trestles were removed and re-erected in position for another span. Travelling cranes were employed to handle the material for the erection of the superstructure. The swing span was erected in its place on the permanent timber dolphin that was placed at right-angles to the bridge. It was in complete working order before it was swung across the channel.

The pivot piers and the swing span with its moving parts and live ring weigh 303 tons, the motive power being electric, with emergency hand gear. The power house is situated on the dolphin, and the power is generated by oil engines driving dynamos producing current at 150 volts, which is stored in a battery of accumulators. The swing span is opened and closed in two minutes.



Hydraulically operated swing bridge at Albert Dock, London. The bridge is not pivoted centrally, but has a long arm of 150 ft. radius and a short arm of 50 ft.

A smaller swing bridge, operated by manual power, carries the main road traffic between Glasgow and Stirling over the Forth and Clyde Canal at Castlecary. This bridge provides a roadway 18 ft. in width over a waterway 21 ft. clear. The main girders are of plate webb construction, 61¼ ft. and 54¾ ft. in overall length. The bridge weighs 160 tons and can be opened or closed in three minutes.

An interesting swing bridge spans the River Nile, Egypt, from Ghizeh near the road to the Pyramids, to the island of Rodah. The bridge is 1,755 ft. or about one-third of a mile in length between abutments, and is divided into 10 spans of 140 ft., two end spans of 70 ft., and a double swing span 220 ft. in length, with two clear openings of 66 ft. The width between parapets is 66 ft., and this is divided into two footpaths 8 ft. in width and a 50-ft. roadway. A double line of tramway of one metre gauge crosses the bridge. The piers are formed of steel cylinders 18 ft. in diameter filled with concrete. The load at the bottom of each cylinder is about 1,400 tons, making a total of nearly 40,000 tons in the foundations. More than 7,000 tons of steel and iron were used in the work. The swing span, which weighs 1,000 tons, is electrically operated and is opened or closed in three minutes.

At the Albert Dock, London, belonging to the Port of London Authority, is a swing bridge crossing obliquely over a 100-ft. communication passage. The bridge has a total length of 200 ft., consisting of a long arm of 150 ft. radius, and a short arm of 50 ft. radius. It has a total width of 39 ft., divided into a roadway 20 ft. 8 in. wide and two footways each 5 ft. in width. A single line railway track passes over the roadway at one side of the bridge. The main girders are of lattice construction placed 26 ft. apart, and form a through type of bridge. Hydraulic power is employed to operate the bridge, which weighs 1,800 tons and is opened or closed in 1¼ minutes.

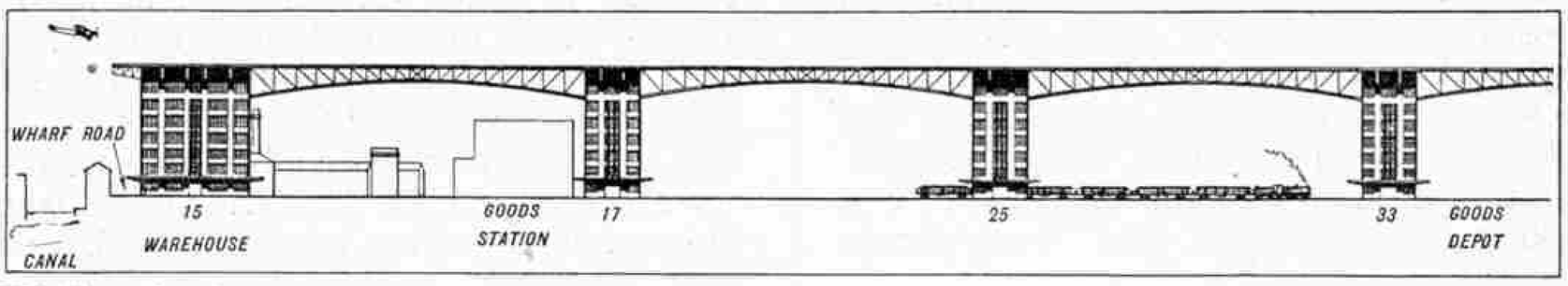
A small swing bridge spans the Union Canal at the Westquarter factory of Imperial Chemical Industries Ltd. The bridge has an overall length of 41 ft. and carries a 12 ft. wide roadway over the canal. It is worked by manual power and can be opened or closed in half a minute.

There are several swing bridges, with unequal arms, across the Manchester Ship Canal. Two of these, built by Sir William Arrol & Co. Ltd., are known respectively as the Knutsford Road and Northwich Road bridges. They are of the same dimensions, and when open provide a clear canal passage 120 ft. wide. Each bridge has a long arm of 148 ft. and a short arm of 100 ft., and turns upon 60 rollers in a circular track 38 ft. 9 in. in diameter. The bridge girders are 30 ft. deep above the turning point.

An Airport in the Heart of London

Unique Scheme for Elevated Aerodrome

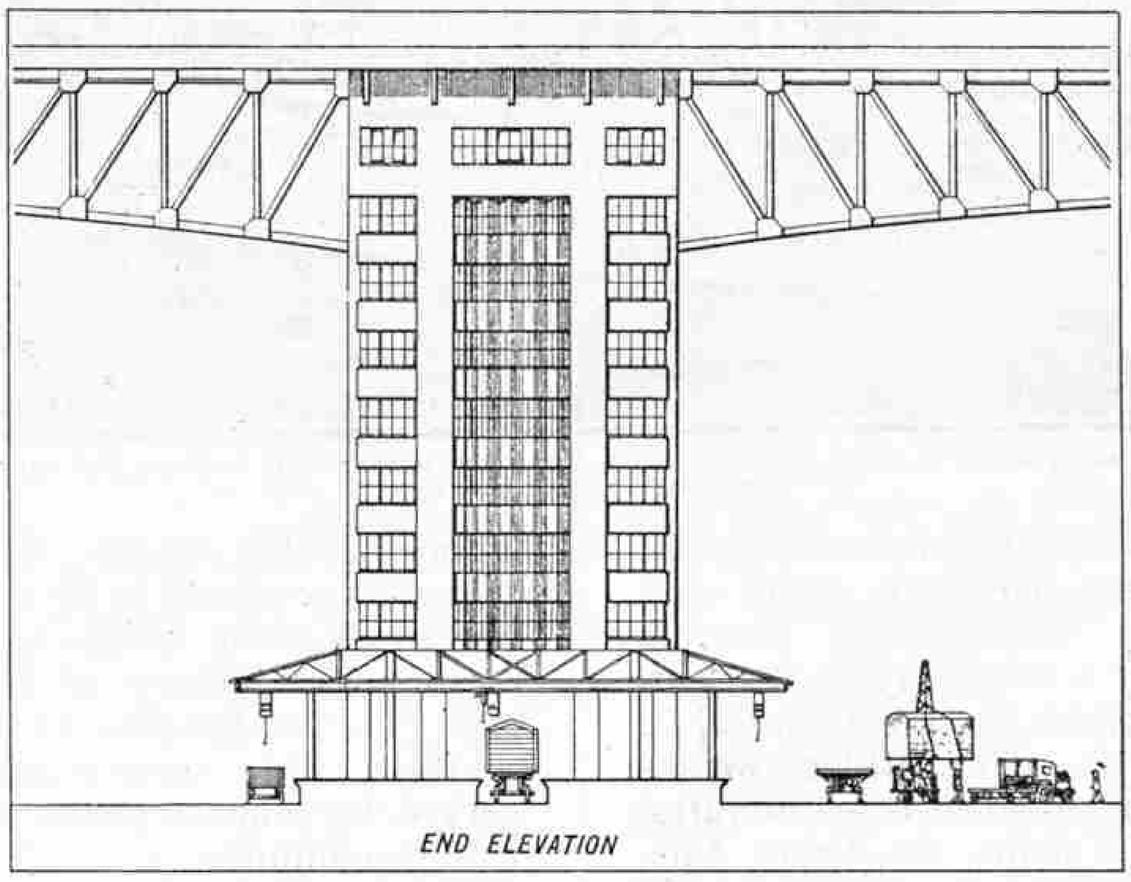
IN countries such as Australia and Canada the great value of the aeroplane as a means of rapid transport can be appreciated far more than in England, for an aeroplane often makes it possible for a journey through undeveloped country to be completed in a few hours, where days would be required by surface transport. In England, however, the distances to be covered are much shorter, and consequently the time saved by air travel is less. Further, as most aerodromes are situated several miles from the centres of the towns they serve, much of the time that is saved in travelling by air is lost in the journey between the aerodrome and the town. This is particularly the case in London, owing to the enormous traffic congestion experienced during the busy hours of the day. A scheme that provides for the construction of an elevated airport in Central London is therefore of great interest, for passengers arriving at the aerodrome would be right in the heart of the city.



This illustration shows a sectional elevation of a portion of one of the elevated runways that are to be used on the proposed Central London Airport at King's Cross. For the illustrations accompanying this article, and much of the information, we are indebted to the Editor of "Modern Transport."

The proposed airport is to be built in the vicinity of the St. Pancras and King's Cross goods stations. It will be linked up with all forms of inland transport, as the aerodrome will be the site of an immense omnibus and long-distance motor coach garage and terminus, and it will be served also by the L.M.S., L.N.E., and Underground Railways. It will also be possible for freight to be distributed by means of the Regent's Canal in the immediate vicinity.

Opponents of the scheme say that it would not be in the interests of public safety for aeroplanes to fly low over densely populated areas, as would be necessary for all machines making use of the aerodrome. The use of the airport would be limited to commercial machines, however, which would be of the multi-engined type and would be controlled by specially licensed pilots. All modern multi-engined air liners are capable of maintaining flight with one engine out of commission, and thus if an engine should fail after an aeroplane had taken off from the airport, it would not be necessary for the machine to make an immediate landing, but it could continue its flight and make an emergency landing at Croydon or at one of the other aerodromes in the immediate vicinity of London. If engine trouble should be experienced in an aeroplane making for the airport after it had reached the boundaries of the city, it would be entirely at the pilot's discretion whether he should turn and make for an aerodrome in the outskirts, or carry on and effect a normal landing at the airport.



One of the pillars that will support the elevated aerodrome.

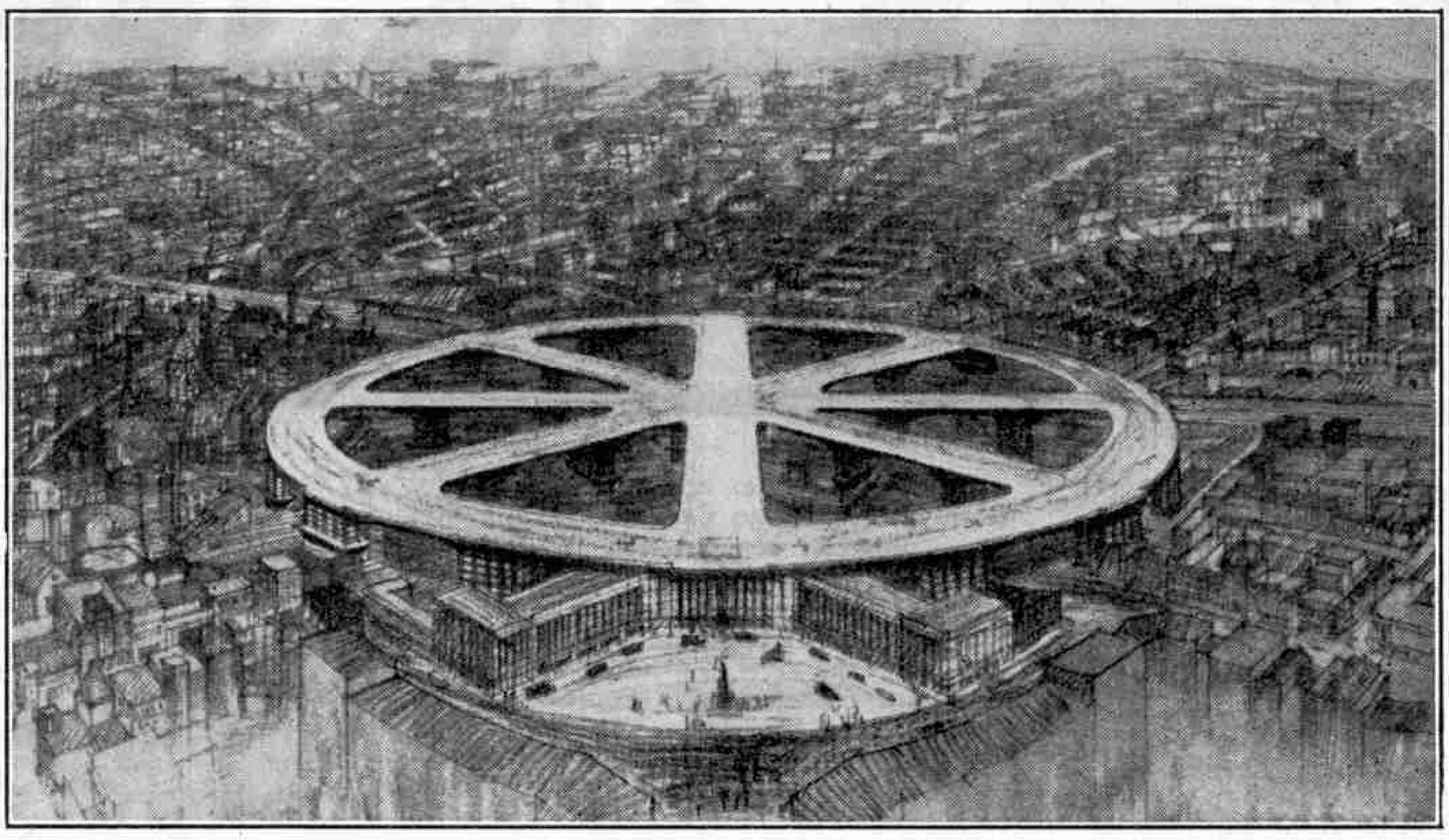
The danger of fire is another question that has been raised, but this would be eliminated by allowing only aeroplanes equipped with engines employing heavy oil, or some other fuel that is not readily inflammable under ordinary conditions, to use the airport. The degree of success that has been attained with existing systems of blind flying, and the use of radio when dense fog or other unsuitable conditions prevail, would also assist in keeping the airport free from accidents.

The scheme for the construction of the airport was conceived, and the designs were prepared, by the London consulting engineers and architects C. W. Glover and Partners. According to the provisional plans the aerodrome is to consist of four runways, each about half-a-mile in length and 250 ft. in width, which means that each runway will be about four times as long as London Bridge, and three times as wide. The runways will be 120 ft. above the ground and will intersect at the centre. They will be joined up at the ends by a peripheral runway. The segmental space between the runways will be left open in order to admit light and air to the space below. The runways are to be constructed of concrete, and to be provided with parapets along the sides to prevent machines or people from falling over.

This system of runways is to be carried on elevated buildings to raise it clear of all obstructions, and to provide safe landing and taking-off facilities for all types of aeroplanes in all directions of wind. A machine will land on one of the runways and, after slowing

down, taxi round the circular way to set down its load of passengers and mails at the main buildings. It will then travel under its own power to a parking place, or to an elevator—similar to those employed on aircraft carriers—that will lower it to hangars accommodated in a number, probably four, of the supporting buildings.

An elaborate system of lighting has been planned for the aerodrome. Each of the runways is to be floodlighted from units concealed in the parapets, which will make it possible for the surface to be brightly illuminated without the pilot being dazzled by the beam. All the runways will not be lighted up together, however, but only the one that is in the direction of the wind and is therefore most suitable for landing at the particular time.



An artist's sketch of the proposed airport, the estimated cost of which exceeds £5,000,000.

The switches that control the lights will be operated automatically, so that if the wind should change during the night the lights of the runway in use will go out, and those of the one in the path of the "new" wind will be switched on. This will prevent mistakes through errors of judgment on the part of the official whose duty it would be to switch the lights on and off if they were manually operated, for with an aerodrome of this nature such mistakes would probably have serious results.

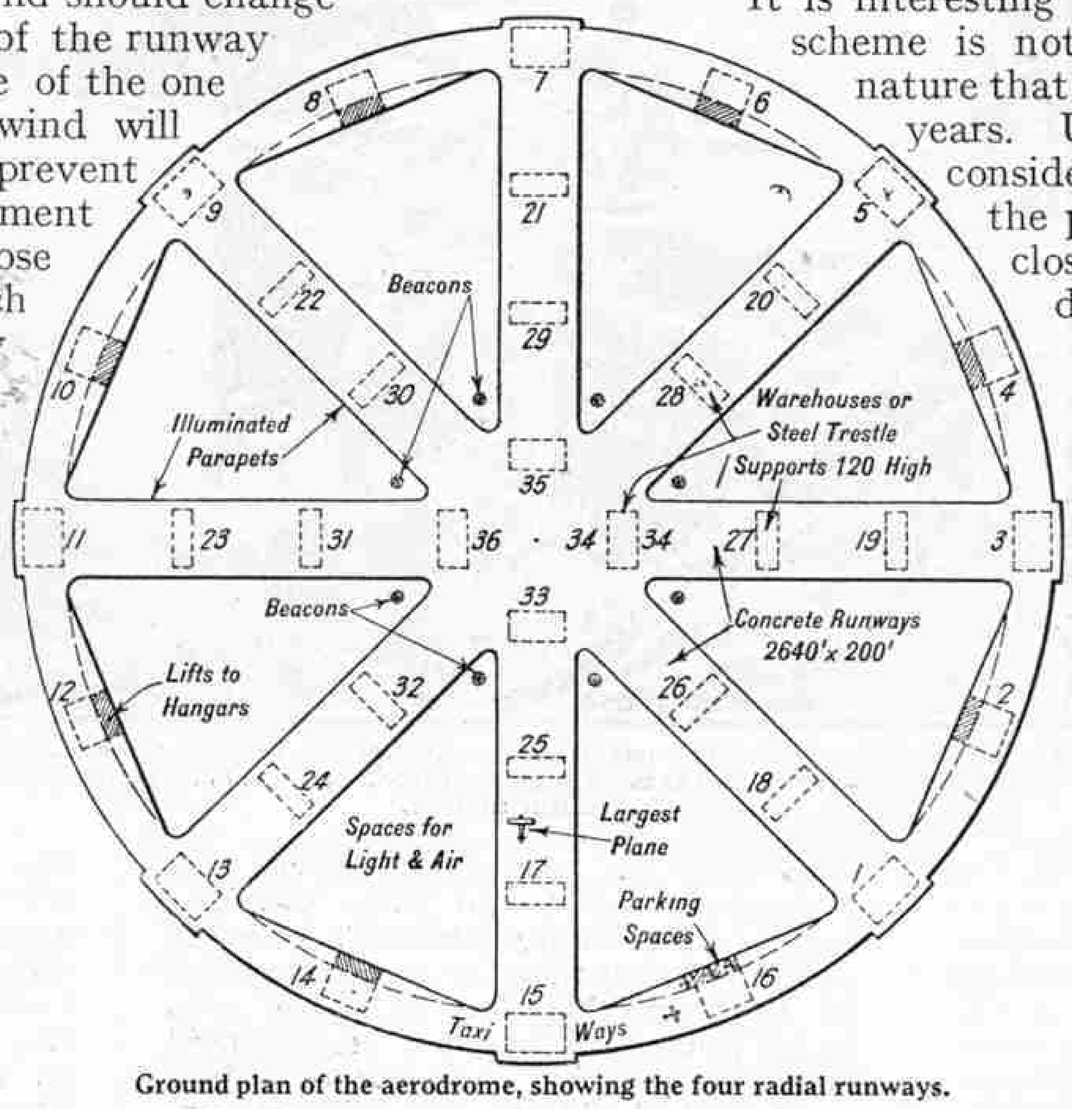
It is interesting to note that in a model of the aerodrome that was on exhibition at the Charing Cross Underground Station, the mechanism for controlling the lighting was made up of "*Meccano*" parts.

The area that has been selected as most suitable for the erection of the necessary buildings is 130 acres in extent, of which 15 acres are actually built upon. The buildings are mostly very old, however, and no great difficulty should be experienced in obtaining permission to pull them down. The buildings to be erected would provide in all about 75 acres of floor space, and would be devoted to warehouses, offices, shops, flats, garages and hotel accommodation. A certain number of the buildings would be set aside as tenement houses for the use of people who had been dispossessed of the houses demolished. The work provides also for the construction of a new road, to be known as "*Aerial Way*," leading from Pentonville Road to the chief building, with a circulating area for buses and motor traffic in front of it. It would also be necessary for the goods yards and sidings at King's Cross to be replanned, and for an alteration of the alignment of the main passenger line to be made, in addition to the construction of several bridges. The estimated total cost is £5,000,000.

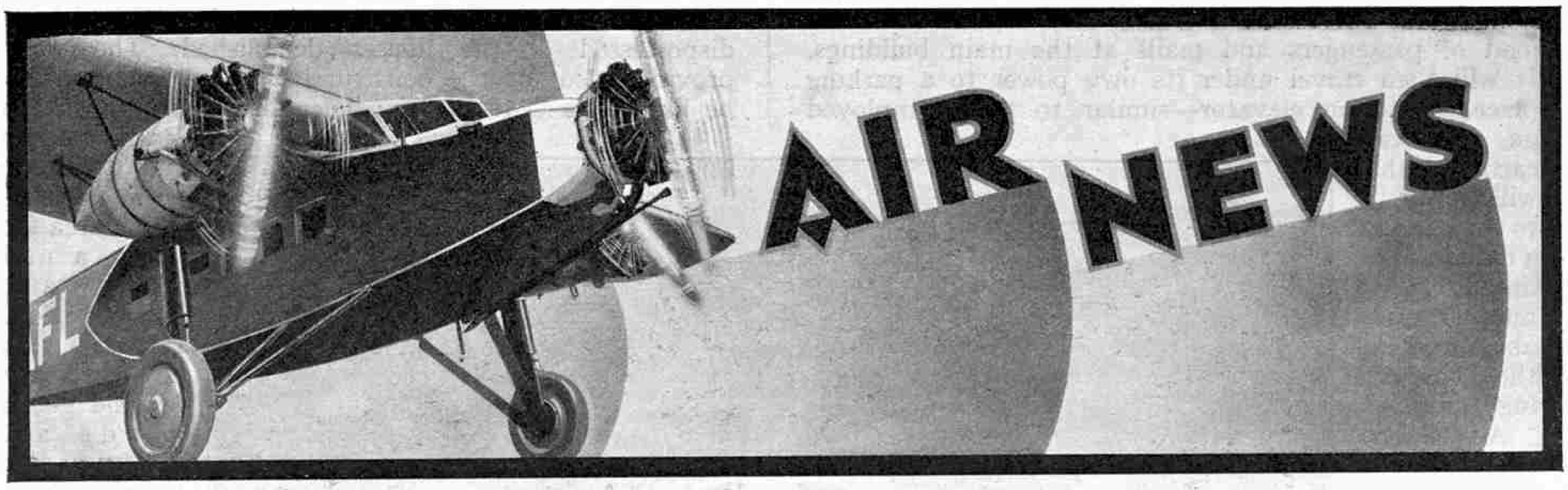
The scheme has the support of many influential people, and a company, known as Central Airports Ltd., has been formed to undertake the work. Colonel The Master of Sempill, A.F.C., A.F.R.Ae.S., has been appointed Aeronautical Consultant to the company.

It is interesting to note that the King's Cross scheme is not the only suggestion of this nature that has been put forward in recent years. Under one project that was considered, a large portion of one of the parks in London was to be enclosed and made into an aerodrome. Hyde Park would of course be most suitable for this purpose, but such a scheme would be certain to meet with strong public opposition, as have other schemes involving the enclosure of one of London's open spaces.

An interesting drawing of an elevated aerodrome of the future was shown on the cover of our issue for May 1932. This was different from the King's Cross scheme, as the aerodrome was shown on the roof of a skyscraper, many hundreds of feet above sea level. Aeroplanes would land on the roof of this building and the passengers be carried down to the street by high speed elevators. It is of course possible that when helicopters and "Autogiros" have been developed more fully, elaborate landing grounds of any kind will be unnecessary, owing to the small areas in which such machines can take off and alight.



Ground plan of the aerodrome, showing the four radial runways.



Imperial Airways News

A new evening air service to Paris that has been inaugurated by Imperial Airways enables passengers to reach the French capital at 7.15 p.m. The service in the reverse direction from Paris to London flies to the same time schedule.

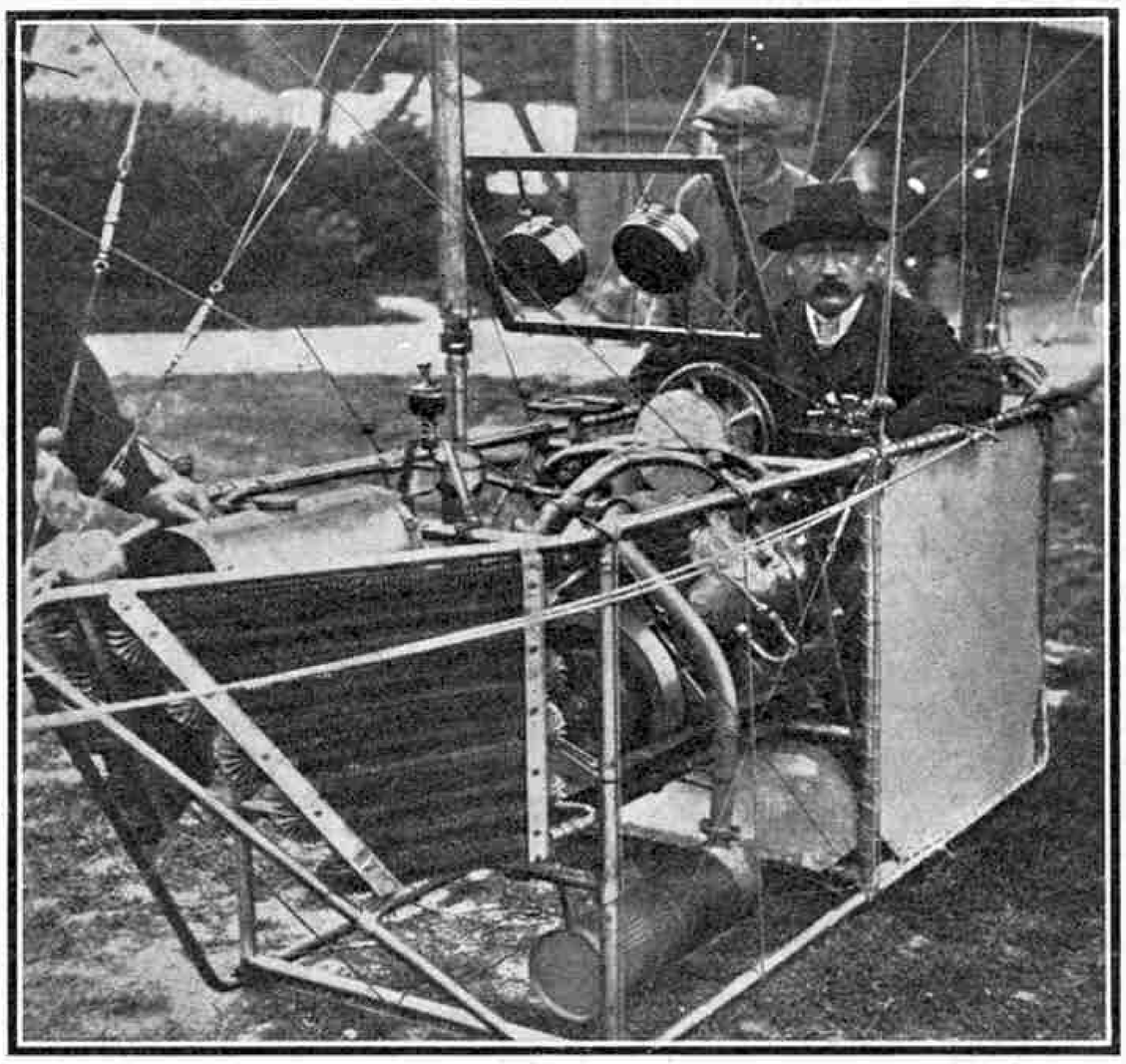
The service is expected to be of particular value to business men, for it will enable them to complete a day's work, catch the service and be in Paris in time for dinner, thus avoiding any break in the actual working day. The service also makes it possible for those who wish to make a short stay in Paris to travel on the early morning service to Paris, stay six hours in the French capital and return by the evening service.

During the winter there were three services a day between London and Paris, but last month, when the summer service came into operation, this number was increased to five services daily in each direction. The big modern air liners employed to operate the cross-channel services are equipped to enable a complete service of meals to be given while in the air. The meals provided are breakfast, luncheon, tea and dinner.

An interesting proof has been afforded of the time saving of the air-and-ocean freight service that was instituted some time ago by Imperial Airways, in conjunction with ocean shipping companies, when an urgent consignment of goods was handed in for dispatch by mailplane, air liner and ocean liner over a distance of 12,000 miles from Los Angeles, California to Poona in India. After being flown by air mail from Los Angeles to New York the parcel was put on an ocean liner departing for Europe, and on arriving in London was sent to the Croydon Airport to catch one of the outgoing air liners to India. As a result the parcel reached its destination in 18 days, a saving of 15 days over ordinary methods of transmission.

By the new service a parcel despatched from New York to Cairo reaches its destination in 10 days, as against 21 or 23 days by other means, while in the case of a consignment from, say, New York to Baghdad, the air and sea time of 11 days compares with 36 to 42 days by ordinary surface transport routes. The time savings are particularly noticeable along the African airway, for a parcel can be sent from New York to Capetown in 18 days as against 28 to 32 days by ordinary means. It is estimated that in the case of specie or coin money, and bonds, the saving of interest alone effected by using the new service is more than sufficient to meet the express charges involved.

It is well recognised that the acid test of the safety, speed and reliability of any form of transport is the insurance rates that are charged to cover risk of passengers or freight when travelling by it. The safety and efficiency of air transport has therefore been exemplified by the fact that the insurance rates for air passengers have now been reduced from 12/- per day for a sum of £1,000, to 1/- per £1,000 per day. Policies embodying this new and favourable rate are available on demand by passengers at any Imperial Airways office or station.



The Comte de la Vaulx, for some years president of the Fédération Aéronautique Internationale, shown in the car of his dirigible in 1906. He was killed in an aeroplane accident in 1930.

Italian Atlantic Flight

This summer a formation flight involving some 20 or 30 Italian machines is to be made across the Atlantic Ocean. In order to prevent a re-occurrence of the tragedy associated with the last Italian formation flight across the Atlantic, the Italian Government has chartered six British trawlers that are to be stationed at intervals between the Irish Channel and the coast of America. The trawlers will be fitted with long distance wireless apparatus, and thus will be able to go to the assistance of any aircraft that may be forced down.

Regular Transatlantic Air Service

A regular service across the South Atlantic is to be operated by the Deutsche Luft Hansa. The service will connect Berlin and Buenos Aires and will be operated on a five-day basis once a fortnight. Thus the Germans will have a weekly service to South America, for the "*Graf Zeppelin*" also is to make fortnightly flights.

Mails and passengers will be carried from Berlin to Cadiz, a distance of 1,560 miles, in fast landplanes, and then will be flown the 1,900 miles to Bathurst, in Gambia, in flying boats. The crossing of the South Atlantic will also be made in flying boats, but the 1,800-mile journey will be made in two stages, for the machines will be refuelled halfway across from a converted liner, the "*Westfalen.*" This is a vessel of 5,000 tons, and it will be provided with a canvas apron similar to the Kiwull "*Watersail*" illustrated and described in "*Speeding up the Mails,*" on page 200 of our issue for March 1930. The flying boat will taxi on to the end of the apron and then be lifted by crane into the ship. After the petrol and oil tanks have been filled up it will be launched by means of a Heinkel catapult. The next stop will be at Pernambuco, where the mails will be transferred to machines operated by the Condor Syndicate, a subsidiary company of the Deutsche Luft Hansa, who will carry them to Rio, some 1,200 miles away, and then on to Buenos Aires, 1,300 miles from Rio, and about 7,700 miles from Berlin.

It is interesting to note that arrangements are being made for the "*Westfalen*" to throw oil overboard during rough weather in order to provide a smooth path on which the flying boats may alight in safety.

The Air Ministry have stated that although they will watch the experiment with interest, there can be no question of their operating a similar service at present.

Signal Searchlight for Aircraft

A new instrument for signalling to aircraft from an aerodrome has been produced by engineers of the Westinghouse Electric & Manufacturing Co. It is a small but extremely powerful searchlight gun giving a beam of white, red or green light, and until this beam of light is directed on an aeroplane, either in the air or on the ground, no pilot may land or take off.

Although the new gun is only 8½ in. in diameter, 16 in. in length and 7 lb. in weight, it has a maximum beam of 350,000 candle power. Its small size and light weight permit operators or traffic officers to use it for long periods with the minimum of fatigue, a very important feature on busy aerodromes where landing and taking-off signals often have to be given to aeroplanes at the rate of five a minute.

The Westinghouse unit is equipped with two pistol grip handles and is as carefully balanced as a rifle, for it must be aimed very carefully as it shoots a beam of light only 12 in. in width. The beam is so powerful that it is normally visible for a distance of 10 miles in the daytime and 15 miles at night, and it may be made white, red or green by pulling the front trigger of the searchlight. As the pilot of an aeroplane is circling an airport, the traffic officer "shoots" him with the beam. If the light is red the pilot does not land, but he is allowed to do so if he is shown a green light. The white beam is used to pick out objects on the ground to aid the pilot when he is landing at night. A special sighting tube is provided, and the field of view of this is so arranged that the operator can readily aim the light and at the same time see that no aeroplane other than the one to which he is transmitting orders is in the limits of his signal.

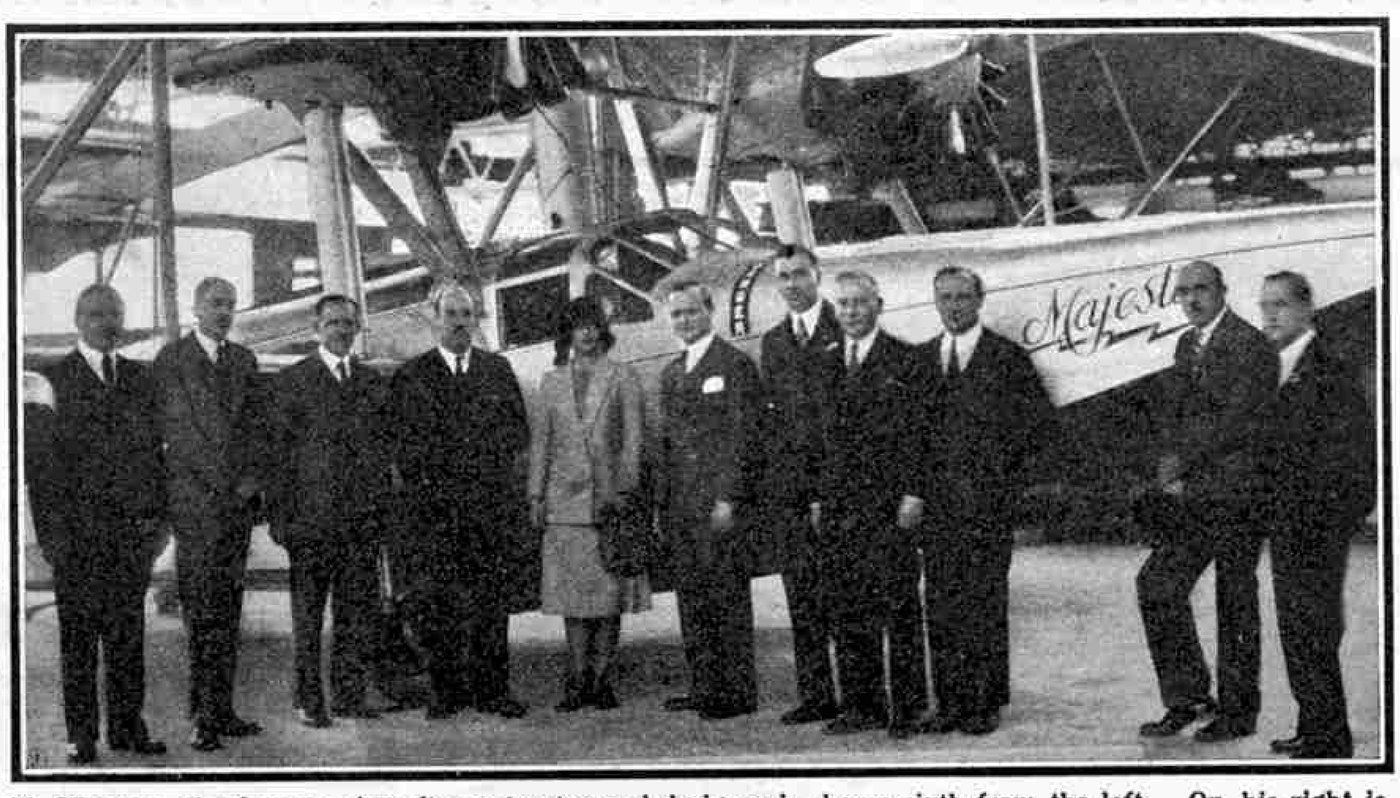
A Gold Rush by Air

Those who sought fortunes in gold rushes in days of old had to rely on the most primitive forms of transport. As a contrast, many of the prospectors who hastened to Kenya Colony in the gold rush in the Kakemege Territory made the journey by air. The usual scheme followed was to book through to Kisumu by the Imperial Airways African service and then to hurry by surface transport to Kakemega, which is only 31 miles away. Engineers, business men, and fortune seekers of all types made their way to Kakemega, for the service made the centre of the rush only seven days' journey from London ; while for those flying northward up the African route it was reached in not more than four days from Capetown. Many more days would have been required to make the journey by land transport, and of course those first on the spot were able to stake out the most promising claims.

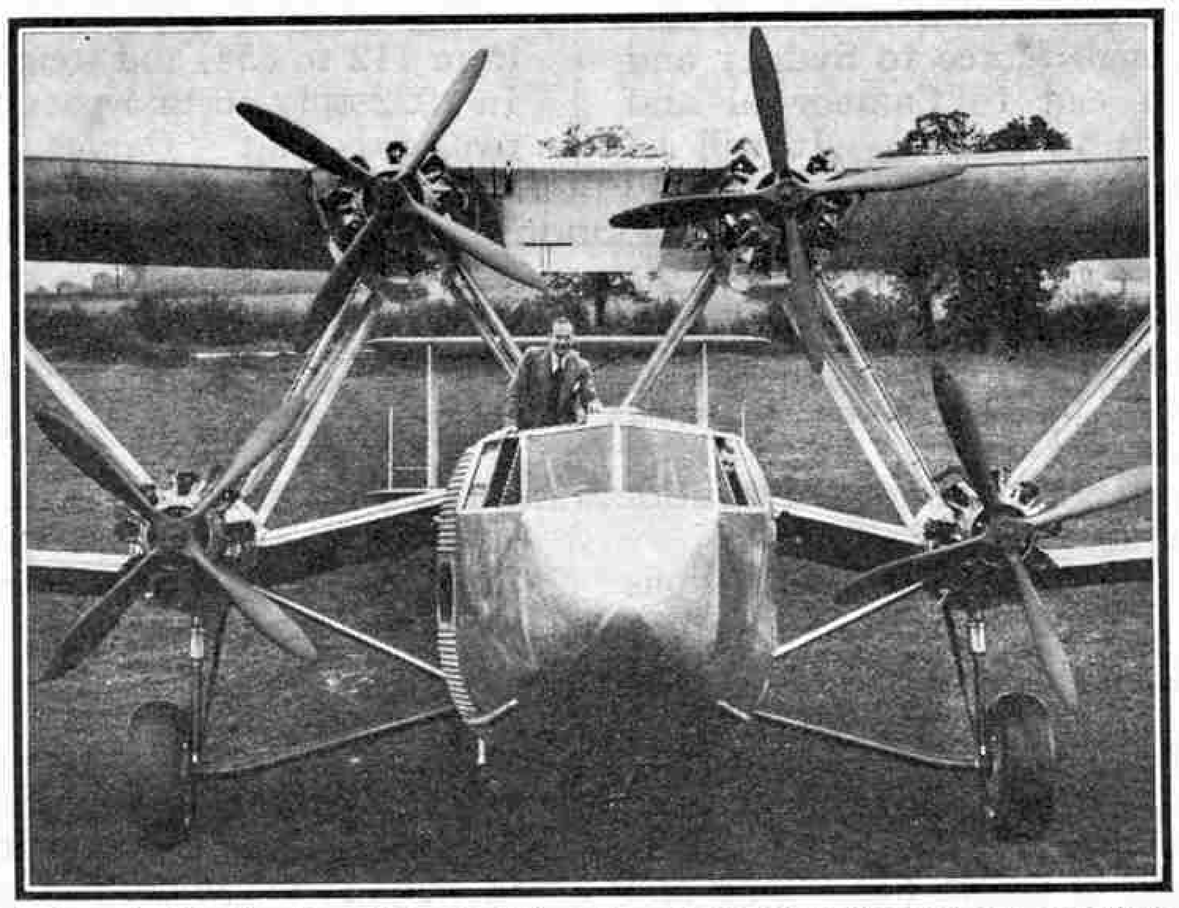
Airport for Galway

A company has been formed to establish an international sea and air port on the shores of Galway Bay. The point selected by Sir Alan Cobham, aviation consultant to the company, is some three miles from Galway, and it is hoped that when the aerodrome is finished passengers landed from Atlantic liners will be carried by means of cars or a light railway straight to the aerodrome and then flown over to England.

The area of the site is about 300 acres, and it is estimated that the cost of the aerodrome will be about £300,000, exclusive of buildings and other works. It will be necessary for part of the ground that is to be used to be reclaimed from the sea. As the point is sheltered from the heavy Atlantic seas, it is thought that it would also make an excellent flying boat base.



M. Sikorsky, the famous aircraft constructor and designer is shown sixth from the left. On his right is the Grand Duchess Kyra of Russia.



A view of a Handley Page "Hannibal" machine showing how the pilot can employ to advantage the sliding roof over the cockpit.

British Petrol for Air Ministry

A contract for twelve months' supply of aviation spirit made from British coal has been awarded by the Air Ministry. The petrol is separated from crude oil obtained as a by-product in the manufacture of coalite smokeless fuel. The petrol is supplied by Carless, Capel & Leonard.

R.A.F. Vacancies

The Air Ministry announce that vacancies exist in the Royal Air Force for well-educated boys, in possession of an approved first School Certificate, between the ages of 15½ and 17 years, to enter as apprentice clerks in July next. Entry will be by selection from among applicants with the necessary educational qualifications. Detailed information regarding the apprentice clerk scheme can be obtained from the Secretary, Air Ministry (Apprentice Clerks Department), Gwydyr House, Whitehall, London, S.W.1. Successful candidates will be required to complete 12 years' regular Air Force service after reaching the age of 18. At the age of 30 they will normally return to civil life, but a limited number may, subject to service requirements, be permitted to re-engage to complete four years' service qualifying for a pension.

Boys entered under this scheme will be trained up to the age of 18, or as soon after as they complete the prescribed course, in clerical duties. During this period their general education is continued under a staff of graduate teachers.

The apprentice clerk at present receives pay at the rate of 1/– a day for the first year, and 1/6 a day afterwards until he has both attained the age of 18 and successfully completed the course. Thereafter pay at present commences at from 3/– to 4/6 a day, according to the degree of success achieved at the final examination. In addition, free board and lodgings and an allowance for uniform are provided.

The King's Cup

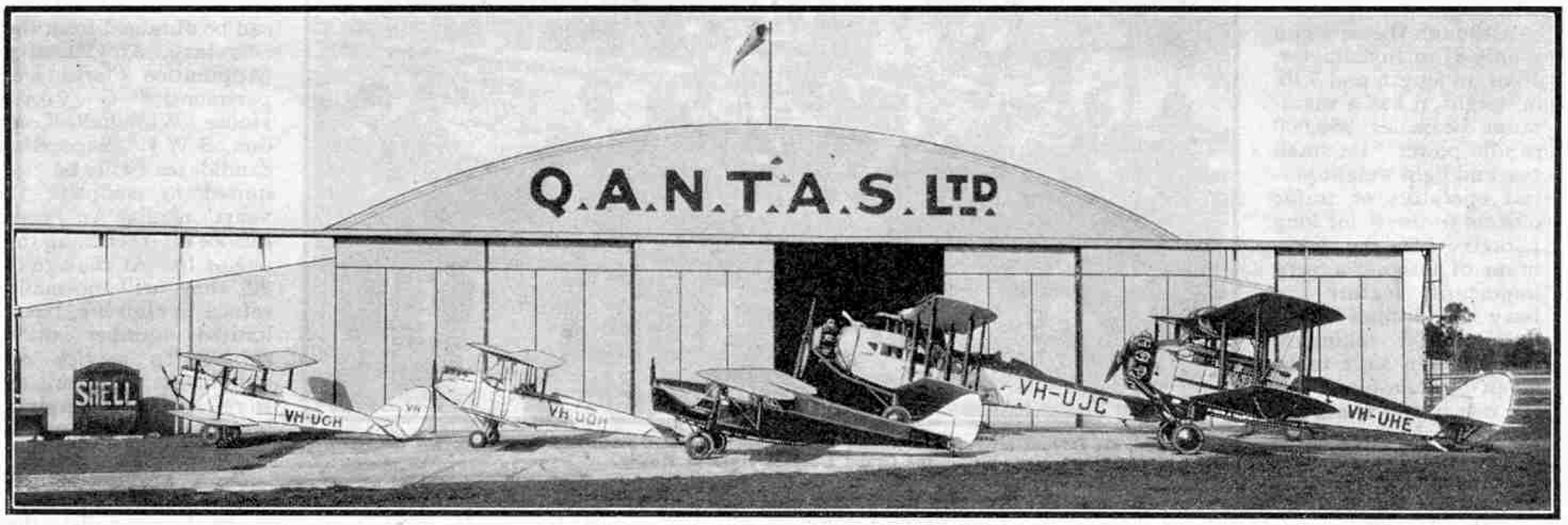
The race for the King's Cup this year is to take place on Saturday, 8th July, and the start and finish of the event is to be at the De Havilland Aerodrome at Hatfield. The course is approximately 800 miles in length and will be flown in one day. The race is open to any British pilot who has flown solo for at least 100 hours prior to the final date of entry.

The race differs from last year's event in the fact that heats will be flown, followed by a semi-final and then a final race. There will be four rounds in all, and these will start and finish at Hatfield Aerodrome. Final details have not yet been settled, but it is thought that there will be eight heats in the first round, four in the second, two in the semi-final, and then the final. The four fastest machines in each heat will probably be the ones winning through into the next round.

All machines entered will be handicapped from a speed of 110 m.p.h., but there will be no re-handicapping during the event as this might lead to much confusion and annoyance.

Famous Air Line Companies

IV.—Queensland and Northern Territory Aerial Services Ltd.



QUEENSLAND & Northern Territory Aerial Services Ltd., or "*Qantas*," as it is generally known, is one of the leading air service companies in Australia. It was formed in 1920 with the object of establishing an air service between Charleville, Blackall, Longreach, Winton and Cloncurry, and it was also hoped eventually to extend the southern end of the service from Charleville through Moree to Sydney and Brisbane, and the northern end to Camooweal and across the Barkly Tablelands to Darwin. It will be seen that this programme provided for a very complete system of aerial communication for the "out-back," as the interior regions of Australia are called. In addition, the company was to carry out air taxi work and joy riding in Western Queensland. Two old war-time types of aeroplanes were acquired to carry out this ambitious programme.

The above photograph shows part of the fleet of "Qantas" at Archerfield Aerodrome, Brisbane. For the illustrations to this article we are indebted to Queensland and Northern Territory Aerial Services Ltd.

From this beginning "*Qantas*" has grown until it now serves 15 towns, with rail or coach connections to many other places. The fleet employed consists of 11 aeroplanes, and a total of 34 aeroplanes have been owned and used by the company from time to time. Six pilots are employed, each of whom has a long and extensive experience of flying conditions in Queensland, and a minimum flying experience of seven years.

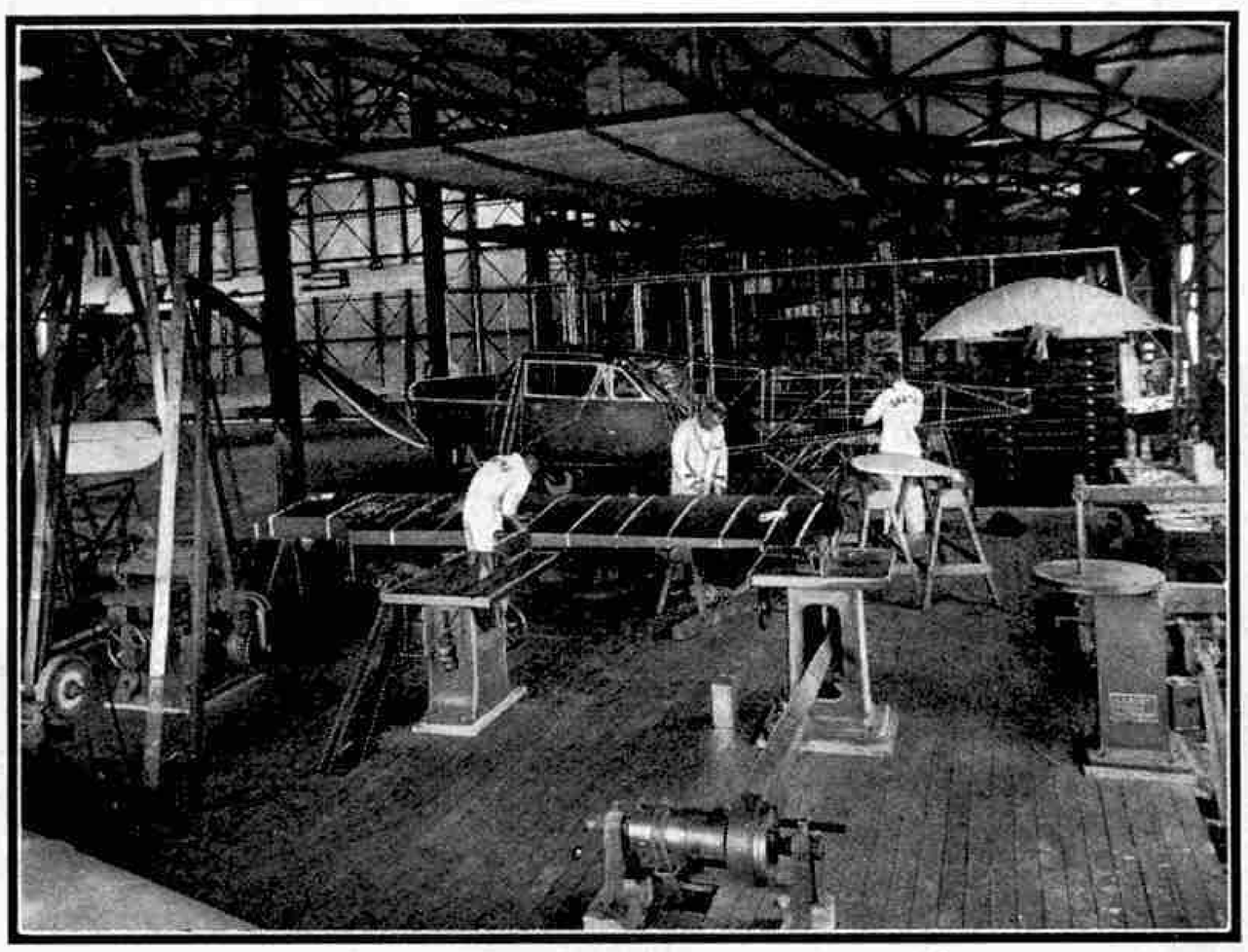
Some idea of the progress that has been made may be gained from a comparison of figures for 1922, when the first air route regularly operated by "*Qantas*" was inaugurated, and for 1932, figures for which year are now available. In 1922 the amount of subsidy paid to "*Qantas*" by the Government was 4/– for every mile flown, by 1932 it had dropped to 2/7 per mile. The regularly operated route mileage for the two years was 577 and 1,484 respectively, and the respective aircraft employed numbered five and 11. The cruising speed of the early types was about 70 m.p.h., while the machines now in service have cruising speeds of approximately 100 m.p.h. The modern machines carry eight passengers, as compared with two carried by the early types.

The longest regular daily stage flown with mails has more than doubled in the 10 years, being now 711 miles as compared with 311 in 1922. The air mail carried has increased from 440 lb. to 3,745 lb., route passengers from 112 to 654, and freight from 659 lb. to 41,998½ lb. In 1922 only 16 taxi passengers had been carried in the two years that "*Qantas*" had been in operation; the number at the end of 1932 was 201. The total distance flown at the end of 1922 amounted to 44,838 miles, while at the end of last year 269,233 miles had been flown.

"*Qantas*" undertake other work in addition to the transport of mails, passengers and freight over regular air lines. One important branch is concerned with the carrying out of what are known as "mercy flights." This consists of transporting doctors by aeroplane to remote regions where serious accidents have occurred or epidemics broken out, or the transport of seriously injured people to hospitals. The air taxi service also enables miners, mining engineers, surveyors and other people to travel in comfort to remote regions of the continent. Journeys to many places that would take days by ordinary means of transport can be completed in hours when made by aeroplane.

The history of "*Qantas*" makes interesting reading. It was found impossible to operate a regular air service immediately after the formation of the company in 1920, although strong efforts were made to secure Government support for the service between Charleville and Cloncurry. The two war-time machines that constituted the first "*Qantas*" air fleet were used for air taxi work and joy riding, and the whole of the western parts of Queensland were visited during 1920 and 1921. Progress was very slow during the first few years, however, and during the

first half of 1922 the company was on the point of closing down on several occasions. The difficulties were overcome, however, and on 7th November, 1922, a subsidised service between Charleville and Cloncurry was commenced. The distance between these two places is 577 miles, and the route was operated by war-time machines carrying two passengers. The service was carried on successfully and to schedule in spite of the unsuitability of these machines and the frequent engine trouble that was experienced with them, and towards the end of 1923 it was found possible to acquire two De Havilland 9C converted war machines to replace the older ones. These carried three passengers and greatly added to the efficiency of the service.



Work in progress in one of the "Qantas" hangars at Brisbane.

After this, operations over the route continued satisfactorily, and an increased number of people made use of the service. In 1924 the traffic regularly carried warranted the purchase of a D.H.50. This type carried four passengers in an enclosed cabin, and it marked the first introduction into Australia of a successful post-war type of passenger aircraft.

Excellent work was done throughout the whole of 1925, the taxi passengers and the passengers and freight carried on the air service being more than double those carried in the previous year. The air mails flown also increased by about 50 per cent. It was in this year, in fact, that the company's only regularly operated air line began to justify itself, and an extension 248 miles in length was inaugurated. This was from Cloncurry to Camooweal, with a stop at Mount Isa, and it brought the total route mileage up to 825.

Another feature of the work that is now being carried out regularly by "*Qantas*" began to be felt in 1927. This was constructional work, and the company's shops at Longreach were gradually built up to enable this to be done. The first machine constructed was a D.H.50, which was christened "*The Iris*"; and the first flight made in it was right across Australia from Longreach to Darwin, with Lord and Lady Stonehaven as passengers. This particular machine has now flown more than 183,000 miles. The first flying school in Queensland was started in the same year. This was at Eagle Farm Aerodrome, Brisbane, and it was at first completely organised and managed by "*Qantas*." After the school had been placed on a firm footing it was handed over to the Queensland Aero Club.

The next outstanding event in the history of the company was another extension of the air service, this time from Cloncurry to Normanton on the Gulf of Carpentaria, a distance of 215 miles. This extension was inaugurated on 1st July, 1927, and brought the total distance of regularly operated "*Qantas*" air line to 1,040 miles. It is interesting to note that the first of the world famous D.H. "Moth" machines to be shipped to Australia arrived in Queensland in this year.

In May 1928 a "flying doctor" service was established for the benefit of those living in the "out-back." The ambulance machine was stationed at Cloncurry, and the scheme was financed by the Australian Inland Mission. On 9th May of the same year a regular daily service was inaugurated between Brisbane and Toowoomba and was operated experimentally for seven months. This was the first regular daily service in Australia. The company's building programme also was pushed ahead, and two more D.H. 50 machines, equipped with 360 h.p. Bristol "Jupiter" engines, were built. These machines have seen good service, and one, the "*Atalanta*," has now flown well over 167,000 miles.

Sorting the mails at Mt. Isa, one of the calling places on the "Qantas" air service connecting Brisbane and Normanton.

On 17th April, 1929, the extension from Charleville to Brisbane was opened, and this added 444 miles of air line to the route and brought the total up to 1,484 miles. During the year two new D.H. 61 aeroplanes, powered with 485 h.p. "Jupiter" engines and capable of carrying eight passengers, were put on the route and met with immediate success. In 1930 the company completed the first million miles flown and its first decade of operations. The building programme was completed by the turning out of a sixth D.H. 50, and it is interesting to note that these D.H. machines constructed by "*Qantas*" have flown a total of more than 850,000 miles. In June the headquarters and workshops of the company were moved to Brisbane.

An important feature of the work in 1931 was the carrying of the first official

(Continued on page 388)

A Machine that Never Forgets

The A.T.M. Electro-matic Traffic Control System

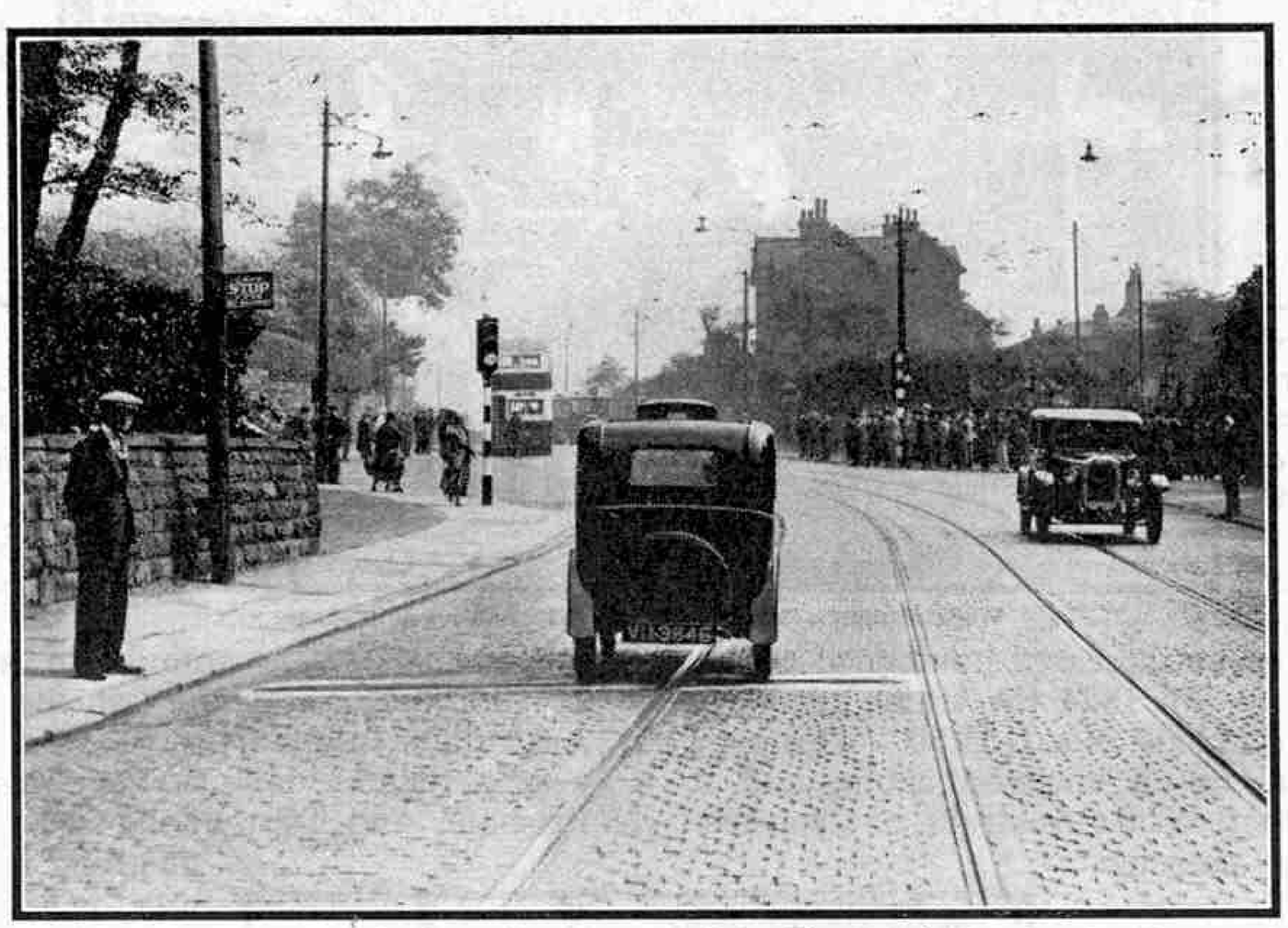
THE earliest form of automatic street traffic robot, which appeared in this country a few years ago, operated on a fixed time cycle, with regular intervals of "stop" and "go" for each road leading to an intersection. Although this system was quite reliable in operation, an unnecessary loss of time was caused, because vehicles were liable to be held up by the "stop" interval even though the other approach roads were clear of traffic. The ideal system of traffic control at crossings or road intersections is of course one in which every vehicle approaching a cross-road automatically secures right-of-way at the earliest possible moment, having due regard to the claims of other vehicles approaching the intersection from other directions.

In view of the complexity and volume of modern traffic at busy city crossings such an ideal might at first sight appear impossible of attainment, but a very ingenious system known as the "A.T.M. Electro-matic System" has now been devised, in which the fixed time periods of "stop" and "go" are done away with, and the "stop" and "go" intervals are determined by the vehicles themselves. This wonderful traffic controller is manufactured by the Automatic Electric Co. Ltd., Strowger Works, Liverpool, and is a very definite improvement on the older method of control. The A.T.M. Electro-matic System actually operates the colour-light signals in accordance with the varying traffic requirements at any instant, and it is this feature that constitutes the basic difference between this system and the older systems operating on the principle of fixed time intervals.

The A.T.M. System has been working for some time very successfully at the intersection of Cornhill and Gracechurch Street in the city of London, and has proved so efficient and reliable that it is rapidly being adopted in other big cities. When first installed it attracts considerable attention from the public, who gather in crowds to watch its almost uncanny working.

A.T.M. Electro-matic Traffic Controller equipment consists of three main units, which are electrically interlinked. The first of these is called the Detector unit, and is used to indicate the presence and movement of approaching vehicles. The second unit is the Controller, which is a really wonderful mechanism that is capable of "thinking," "receiving instructions," and operating the traffic lights. The third unit is the colour-light signal lanterns.

The inclusion of the Detector unit constitutes the chief difference between the Electro-matic System and other street traffic control systems operating on a fixed time cycle, and its function is to indicate to the Controller the arrival of vehicles at the intersection. It is simply a contact-making device operated by pressure, and it lies flush with the road surface, one Detector being placed in each approach road at about 80 ft. from the intersection. The Detector contains no moving parts, and consists merely of two spring steel plates lying parallel and spaced apart about $\frac{1}{8}$ in., the plates, together with their attached electrical connections, being moulded into a substantial rubber envelope. This "contact package," as it is termed, lies in a shallow cast-iron trough mounted on a concrete base in the road. A hard rubber tread surmounts the package and is secured to the trough by steel strips fixed along the sides and ends. Cables laid in a special splice-box make connection from the Detector to the Controller.



The A.T.M. Electro-matic Traffic Control System in operation. The car in the foreground has just passed over a Detector, thus indicating its arrival to the colour-light control mechanism. For our illustrations we are indebted to the Automatic Electric Co. Ltd., Liverpool.

The Detector units are really the "eyes" of the system, and every vehicle passing over them indicates its presence and movement to the Controller, which is the "brain" of the system. The "brain" receives information from the "eyes," and operates the signals to meet the traffic demand. For narrow streets and places where vehicles are liable to pass over the Detector when proceeding away from an intersection the Detector is made uni-directional, that is, it will operate the signals only when depressed by a vehicle approaching the junction, and such vehicles as pass over it when leaving the junction are ignored.

It is obviously impossible for all vehicles to be given right-of-way immediately on arrival at the intersection, but the Electro-matic Controller is so arranged that every vehicle is passed through immediately a safe opportunity occurs. This is accomplished by an ingenious but simple device, which in effect notes the time of arrival and the speed of each approaching vehicle, and regulates the signals in such a way as to pass the vehicles through in the most efficient order. A single car approaching the controlled intersection is given right-of-way immediately, and is never required to slacken speed or stop as is often the case with the fixed period "stop" and "go" system, even though there is no other traffic in the vicinity. If two cars on intersecting roads pass over the Detectors simultaneously, right-of-way is given to one of them, and the arrival of the other is "remembered" by the Controller, and right-of-way given to it immediately the first vehicle is safely through.

The signal lanterns are of the usual

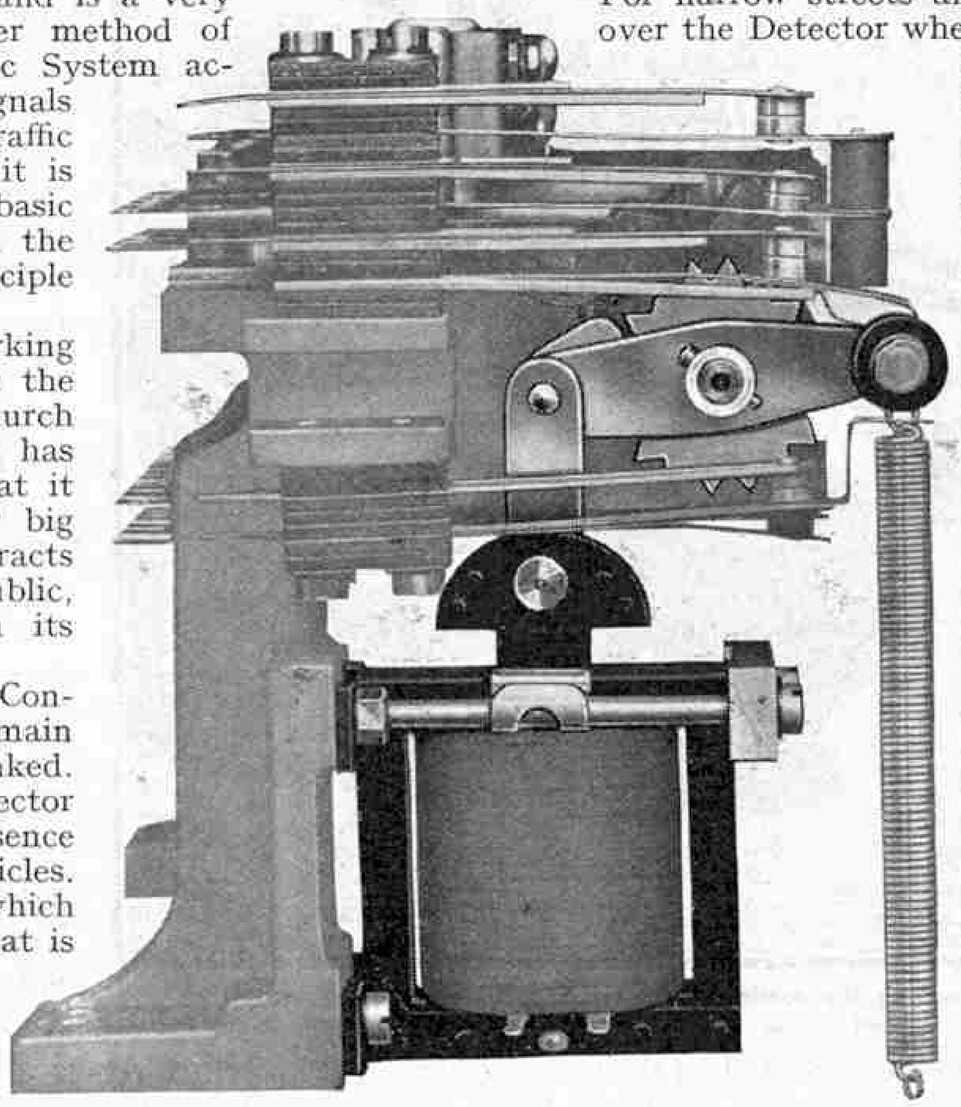


Fig. 1. The solenoid used for "stepping" the camshaft in the Control mechanism.

colour-light pattern, fitted with red, amber and green lenses, which indicate "stop," "caution" and "go" respectively.

The operation of the Electro-matic System is best understood by watching the Controller at work at a simple intersection. In order to give a clear idea of the working of this ingenious Control System we will now describe its operation under actual working conditions, and for the purpose of illustration we will suppose the Controller to be installed at a simple junction of two roads intersecting at right-angles to each other. If a vehicle is approaching the crossing, and the green or "go" light is showing, the indication is that the other intersecting road is clear and that it is safe for the driver to proceed without stopping. The fact that the vehicle in approaching the crossing passes over a Detector ensures that the Controller will allow it sufficient time to clear the crossing before giving right-of-way to the other approach road if a second vehicle should approach before the first is safely through.

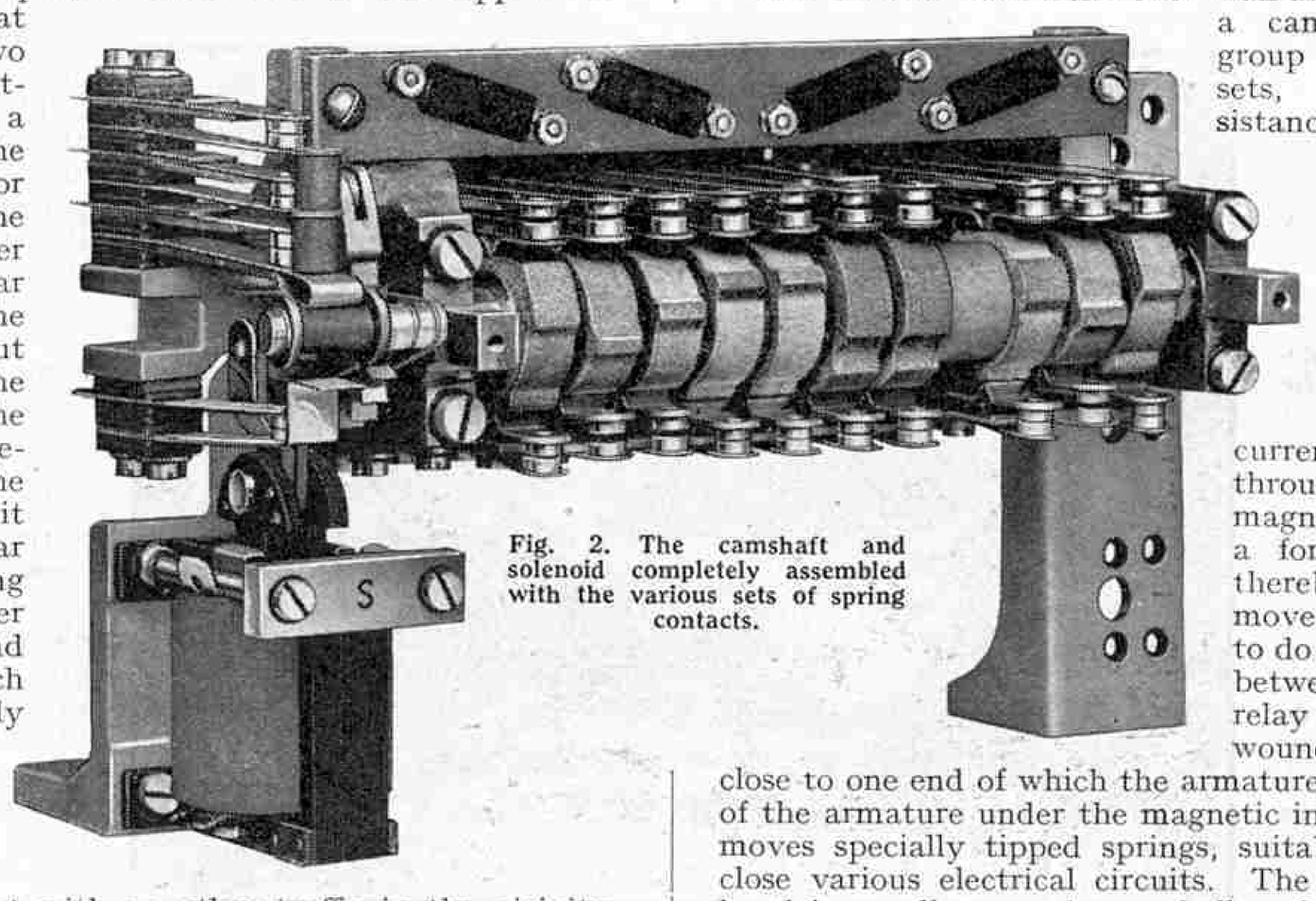


Fig. 2. The camshaft and solenoid completely assembled with the various sets of spring contacts.

Now let us consider the case of a vehicle approaching the intersection with the red or "stop" light showing, but with no other traffic in the vicinity. With the passage of the vehicle over the Detector the signal changes to amber, and providing the driver of the second vehicle is travelling at a safe and reasonable speed, the green light will be showing by the time the intersection is reached, so that he can proceed without stopping.

We will now consider what occurs when continuous streams of traffic are flowing on the roads. In this case each succeeding vehicle to approach down the road having existing right-of-way will, in passing over the Detector, extend the period of right-of-way to permit it crossing in safety. This extension of right-of-way may continue indefinitely providing that there is no traffic waiting on the other cross-road, but as soon as a Detector on a cross-road indicates the arrival of a vehicle, the Controller will transfer the right-of-way to the cross-road at the first gap that occurs in the moving traffic stream.

In addition to indicating the presence of the vehicle the cross-road Detector also initiates another time interval that determines the maximum period during which continuous traffic can keep a vehicle waiting on the cross-road. At the expiration of the maximum time interval the Controller will transfer the right-of-way to the cross-road, after a suitable warning signal with the amber light.

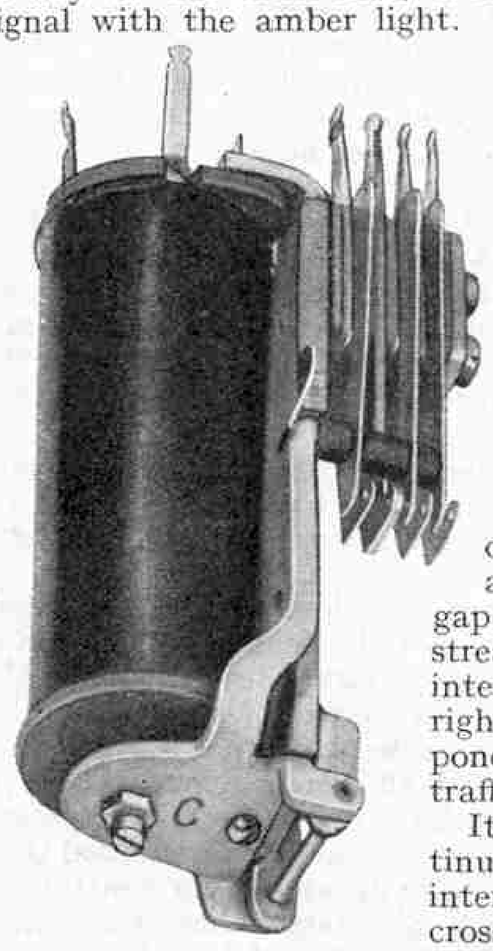


Fig. 4. A typical Relay.

Vehicles on the cross-road may extend the right-of-way in their direction also, but they must surrender it when traffic ceases, or at the end of the maximum interval if there is traffic requiring it.

In no case does one line of traffic secure a monopoly over the other. Waiting traffic is always passed through the first gap that occurs in a traffic stream, or at the end of the maximum interval, hence each road secures the right-of-way in varying ratio corresponding to the constantly fluctuating traffic densities on each approach road.

It will thus be seen that a continuous stream of traffic is never interrupted except by the arrival of cross traffic, which waits only for a gap in the stream and is then allowed to proceed. If no gap occurs within a predetermined period the stream is interrupted while cross traffic passes, and then right-of-way reverts immediately to the continuous stream.

Some idea of the manner in which these various functions are accomplished will be gained from the following simplified description of the mechanism.

The Electro-matic Controller is an assembly of relays, a solenoid, a camshaft associated with a group of circuit-changing spring sets, electrical condensers, resistances, gas discharge tubes, and a standard radio rectifying valve, each performing its own special function in the complete system.

The relays and the solenoid both work on the same general principle, namely, that a current of electricity passed through a coil of wire produces a magnetic field capable of exerting a force on an iron armature, thereby causing the armature to move and, when suitably coupled, to do useful work. The difference between the two is that in a relay the coil of wire is usually wound direct on to an iron core, close to one end of which the armature is hinged. The movement of the armature under the magnetic influence exerted by the core moves specially tipped springs, suitably mounted, to open and close various electrical circuits. The solenoid coil on the other hand is usually wound on a hollow former, the core in this case being the armature. The core (or armature) is suitably mounted and is pulled through the hollow former into the centre of the coil when the latter is energised. The solenoid is usually employed when comparatively large armature movements are necessary. This is the case in the Electro-matic Controller for the step-by-step movement of the camshaft and the opening and closing of the spring contact sets associated with each cam. A typical solenoid is shown in Fig. 1, and a relay in Fig. 4. Fig. 2 illustrates a complete solenoid and camshaft with its various spring sets.

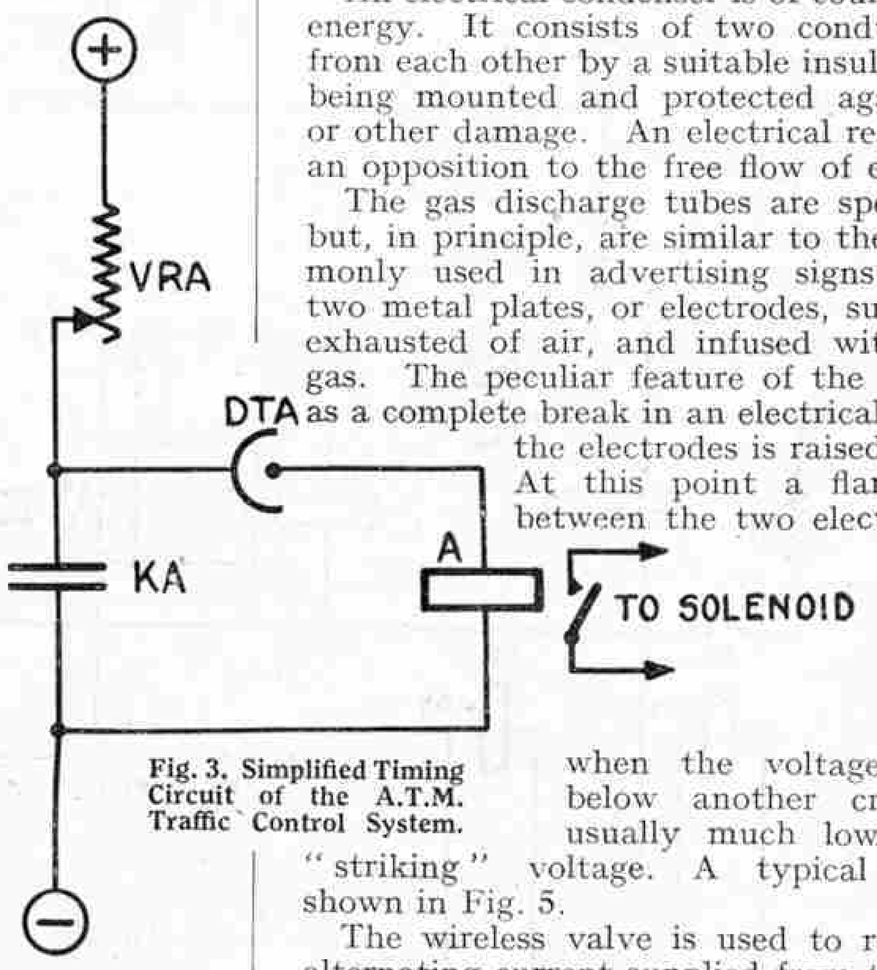


Fig. 3. Simplified Timing Circuit of the A.T.M. Traffic Control System.

An electrical condenser is of course a device for storing electrical energy. It consists of two conducting metal plates, separated from each other by a suitable insulating plate, the whole assembly being mounted and protected against mechanical, atmospheric, or other damage. An electrical resistance is, as its name implies, an opposition to the free flow of electricity.

The gas discharge tubes are specially designed for their work but, in principle, are similar to the strip neon tubes now so commonly used in advertising signs. They consist essentially of two metal plates, or electrodes, suitably disposed in a glass bulb exhausted of air, and infused with a small quantity of special gas. The peculiar feature of the completed tube is that it acts as a complete break in an electrical circuit until the voltage across the electrodes is raised above a certain critical figure. At this point a flame-like discharge takes place between the two electrodes, and while this persists current flows freely through the tube. The discharge ceases only when the voltage is lowered below another critical point, usually much lower than the "striking" voltage. A typical tube is shown in Fig. 5.

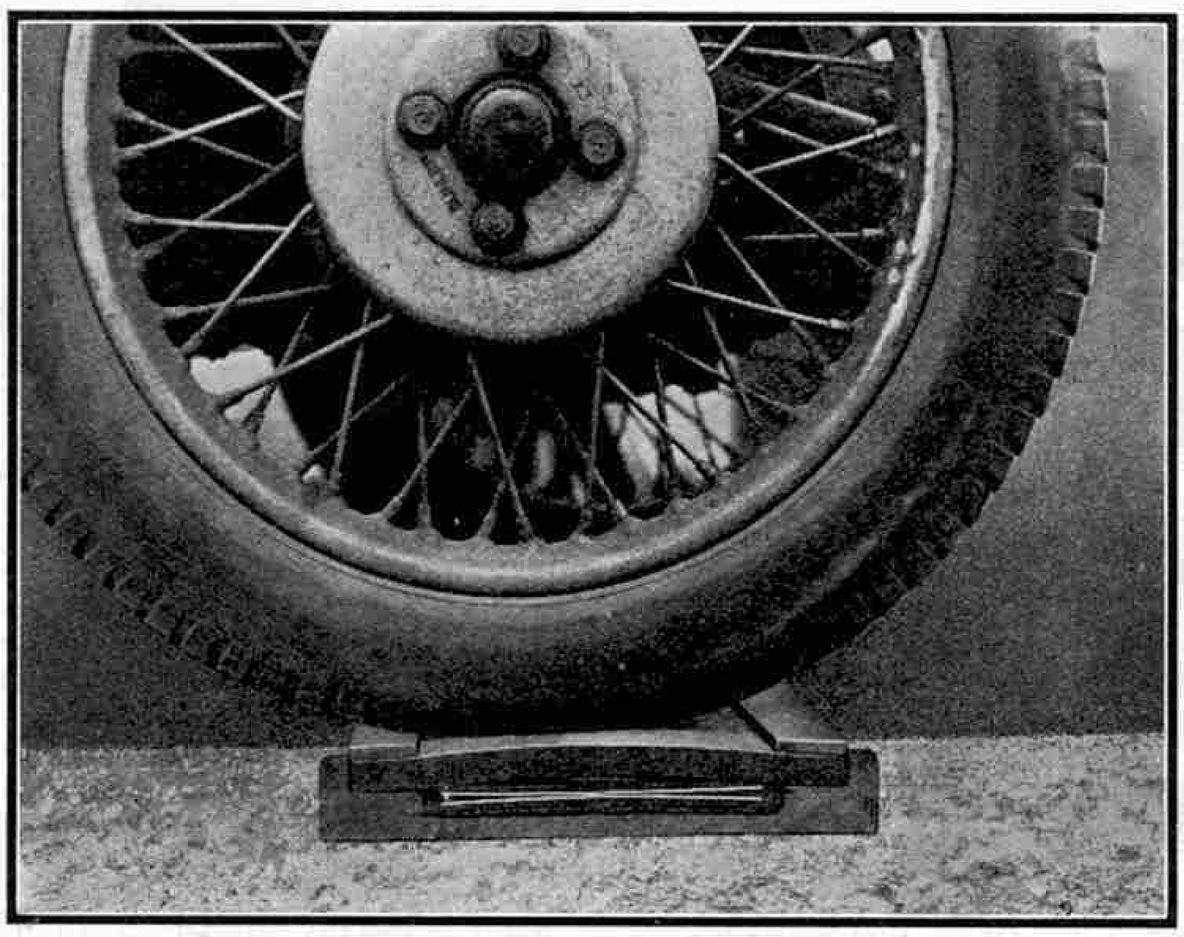
Fig. 5. A gas discharge tube.

The wireless valve is used to rectify the alternating current supplied from the mains, thus providing a uni-directional current of fairly high voltage.

The foregoing summarises the function of the several components assembled in the Electro-matic Controller, and the manner in which the various intervals allowed for traffic to make its movements are timed must next be considered, with reference to Fig. 3. One side of the high voltage uni-directional supply provided by the rectifying valve is connected via a variable resistance VRA to one side of a condenser KA, and the other side of the condenser

to the other side of the supply. Current flows into the condenser KA via the resistance, at a rate determined by the amount of resistance included in the circuit. As it is variable, the resistance may be likened to a tap in a water system. Across the condenser is connected the relay A, in series with the discharge tube DTA.

As the condenser fills with electricity, the voltage across its terminals gradually rises. During this period the tube is acting as a break in the circuit, preventing the current from flowing through the relay. Immediately the voltage across the condenser reaches the critical figure, however, discharge commences, and the stored energy is dissipated via the tube and the relay. This latter therefore operates and closes its contact springs, completing, in this case, the solenoid circuit. The consequent movement of the solenoid core steps the camshaft one step to operate the cam springs and change the signals. As soon as the energy is dissipated the tube discharge ceases, the relay and solenoid de-energise, and another interval is required until the steady flow of current into the condenser has again raised the voltage to the critical point. Since both the rate of inflow and the critical discharge voltage of the tube are fixed, under the conditions shown the relay and solenoid will be energised at regular intervals that can be pre-determined, and it is on this very simple arrangement that the whole of the Electro-matic System, with its many special features, is built.



A cross section of the roadway Detector. It is actuated by pressure of the wheels of a vehicle passing over it, and as it is hermetically sealed it is totally immune from the effects of rain, hail or even snow.

The Detector Unit is essentially a contact-making device operated by the passage of a vehicle, and when these contacts close a relay at the Controller is operated and closes its springs. Two such relays are normally provided, one connected to the detectors of one road, and the other to the detectors of the other road. Fig. 6 shows the timing circuit with the springs of the road relays inserted.

The condenser KA charges as already described, eventually reaching and passing the tube discharge voltage, for, if neither road relay is energised, no discharge occurs as the circuit remains open. If a vehicle should pass over the Detector X, however, the road relay RRX will energise and close the springs XA, causing the charge on the condenser to leak away via the resistance DR, and be dissipated without performing any work.

If now a vehicle should almost immediately pass over the detector Y, causing the road relay RRY to energise and close the springs YA, the circuit of the relay and discharge tube will again be completed as in Fig. 3. But, until the time interval required to raise the condenser voltage once again to the tube discharge voltage has elapsed, the relay A will not be operated, and the signals will remain in favour of the vehicle that crossed the Detector X. This, then, is the interval that ensures a vehicle's safe passage across the intersection before permitting the movement of cross traffic.

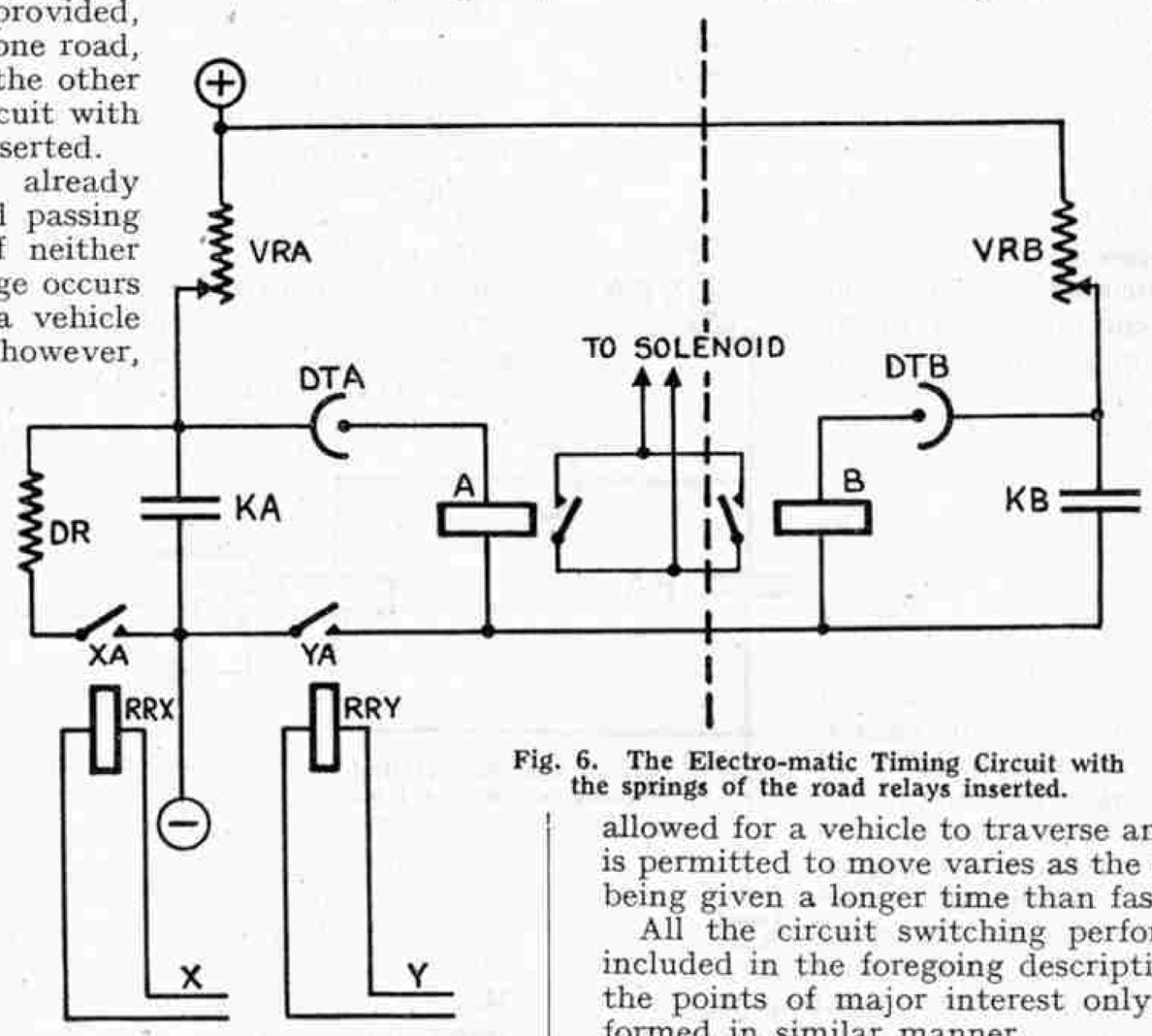


Fig. 6. The Electro-matic Timing Circuit with the springs of the road relays inserted.

A further study of Fig. 6 will show that a succession of vehicles passing over Detector X will each discharge the condenser KA and, so long as they arrive within a time spacing not greater than the time required to raise the condenser voltage from zero to the tube flash-over voltage, this latter voltage will never be reached. Therefore a vehicle crossing Detector Y and making a demand to the Controller for the right-of-way will simply be pulled up at the stop line and made to wait indefinitely. To obviate this a second timing circuit is provided, consisting of the resistance VRB, the condenser KB, the relay B, and the tube DTB, shown to the right of the dotted line in Fig. 6.

Its operation is as follows. Immediately a vehicle crosses Detector Y (the other road having right-of-way), the associated road relay RRY operates, to close contacts YA. If the condenser KA is sufficiently charged, the tube DTA flashes over and sets up the sequence of operations previously described, resulting in the switching over of the right-of-way. If, on the other hand, a constant stream of vehicles across X is dissipating the condenser charge, this result is prevented until the necessary interval occurs in the stream. The closure of the springs YA, however, also completed the second timing circuit and the condenser KB commenced to charge from + via VRB and the springs YA, to —. Condenser KB is entirely unaffected by the passage of vehicles over Detector X and the repeated closure of the springs XA, and, after a certain maximum interval governed by the setting of the resistance VRB, its voltage will eventually rise to the discharge voltage of the tube DTB, which will then flash-over and permit the charge to dissipate itself through the relay B. Relay B therefore closes its springs, completes the solenoid circuit, and causes the right-of-way to revert to the waiting traffic.

Special arrangements are provided to ensure that whenever the right-of-way is taken from a line of traffic in this manner it returns immediately the cross traffic ceases, or at the expiration of a similar predetermined interval.

Referring again to Fig. 6, another important point arises. The time taken to charge the condensers from zero to a certain voltage is dependent on the setting of the variable resistance. Assuming a fully-charged condenser, the time required to discharge it is dependent on the resistance in the discharge circuit. Now in the discharge circuit shown the resistance DR is fixed, but the time during which the springs XA are closed is dependent on the time taken by the vehicle to cross the Detector, and this again is dependent on its speed. Thus the extent of a discharge, and therefore of the amount of re-charge necessary to reach the critical voltage, is a measure of the speed of the vehicles. A small discharge necessitates a short re-charge, and vice-versa. Therefore the time allowed for a vehicle to traverse an intersection before cross traffic is permitted to move varies as the speed of the vehicle, slow traffic being given a longer time than fast.

All the circuit switching performed by the Controller is not included in the foregoing description, which has been confined to the points of major interest only. All other functions are performed in similar manner.

Signal changes are brought about by the camshaft-operated springs, which also cause each road relay to become RRX and RRY in turn, according to which road has the right-of-way. Similarly these camshaft spring movements also change the values of the resistances VRA and VRB to suit the particular signal being timed, thus ensuring at all stages the utmost efficiency of operation.

In this article we have dealt only with the operation of the System at the simple junction of two roads, but it should be understood that the A.T.M. Electro-matic System is fully developed for controlling the most complicated junctions such as intersections with blind corners, multi-way intersections or "T" shaped junctions.

"Royal Scot" Train to Visit America

A Triumph of British Engineering

AS we announced last month, the L.M.S.R. are sending their famous "*Royal Scot*" express to America for exhibition at the Chicago World's Fair that opens next month, and in order to make a tour of the United States and Canada. The locomotive of this train unit is the 4–6–0 passenger locomotive No. 6100 "*Royal Scot*," the first of the class that bears this name, and which now numbers 70. It has been given a complete overhaul at the Crewe Works of the company, followed by running-in trials. Prior to withdrawal from service for overhaul purposes No. 6100 had run a total of 335,658 miles.

This famous locomotive originated in 1927, when the L.M.S.R. decided to provide a more powerful passenger tender locomotive for dealing with the heavy through passenger trains between Euston and Glasgow, and on other main line sections of the system. With this end in view it was decided to build a three-cylinder simple superheated engine of the 4–6–0 type that would have ample capacity for handling these trains.

The boiler was designed to meet the heavy demands for long through runs, and a superheater of the company's standard type was provided. In accordance with British practice the inside firebox is made of copper. The boiler feed is maintained by an exhaust steam injector fitted on the right-hand or fireman's side of the engine. Lubrication to the coupled axleboxes is by means of forced lubrication. The grate arrangement consists of cast iron firebars, with air spaces suitably provided for burning hard coal; and to ensure efficient combustion a firebrick arch of the usual standard type is fitted. The fire-door is of the sliding type operated by means of a hand lever.

As the result of the restricted overall height from rail level, it was necessary to fit the whistle in a horizontal position just in front of the cab. Two water-gauge frames are provided, and the two safety valves are of the "pop" type. A steam reducing valve enables a supply of steam to be afforded to the train for heating purposes. The reversing gear is operated by a hand screw. Steam sanding is provided on the engine, and is applied at the front of the leading and middle coupled wheels, and at the back of the middle coupled wheels, the latter to cover running in the reverse direction. The brake system on both engine and tender is operated by steam.

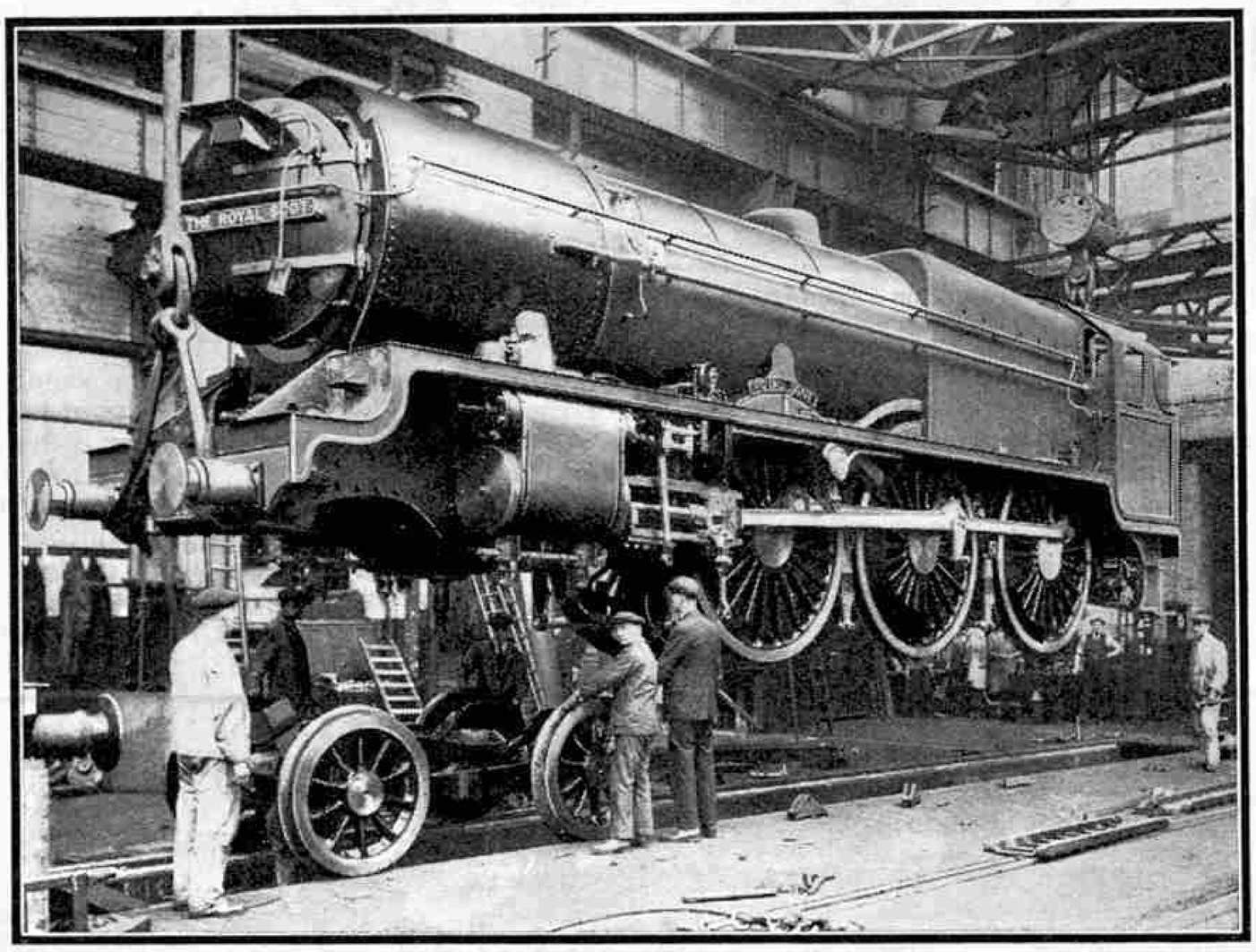
When the locomotive is running at a high speed on easy gradients the exhaust blast is very soft, and it was found that under these conditions there was a tendency for the steam to beat down to the driver's cab window, and thus obscure the view. This has been remedied by the provision at the front end of the engine, on both sides of the smoke-box, of blinker plates which, on account of the direction of the air currents, have the effect of lifting the column of steam from the chimney clear of the cab windows.

The tender has a water capacity of 4,000 gallons, and is carried on six wheels that have "Timken" roller bearings. The coal capacity is nine tons.

In order to permit these locomotives to haul long-distance non-stopping trains, water troughs are provided on the track at intermediate points at intervals that vary from 25 to 60 miles. This arrangement enables water to be picked up by means of the water scoop apparatus fitted on the tender and operated by hand-screw gear. It is of interest to note that these water troughs have on the average a length of 440 yds., and enable approximately 1,400 gallons of water to be picked up at each trough. This system of replenishing locomotives with feed water was originally designed in 1860 by the late Mr. John Ramsbottom of the former London and North Western Railway. The first troughs were between Llanfairfechan and Aber.

While this engine is on exhibition in America an electric headlight will be fixed in front of the smoke-box, and a small floodlight will illuminate the nameplate "*The Royal Scot*," to be specially fitted on the smoke-box door. A hand-operated bell also will be provided in accordance with the regulations.

It is interesting to recall that in 1928 No. 6113, "*Cameronian*," of the "Royal Scot" class, hauled a non-stop express passenger train from Euston to Glasgow, a distance of 400¼ miles, in 8 hrs. 7 min.



The "Royal Scot" locomotive being prepared for its tour in America and Canada. For the illustrations in this article we are indebted to the L.M.S.R.

The train will consist of the following eight vehicles:—corridor third brake, vestibule third-class dining car, electric kitchen car, corridor first vestibule car, lounge brake, third-class sleeper, first-class sleeper, and first-class brake.

The underframe of each car is constructed of rolled steel sections, the solebars, bolsters, longitudinals and headstocks being channels, while the truss frames are built up of angle sections. The bogies are of the four and six-wheeled standard L.M.S.R. type, fitted with steel helical concentric bolster and side laminated bearing springs. With the exception of the first-class sleeping car, which is heated by the "Thermo-Reg" system, steam heating throughout the train is by the Westinghouse atmospheric system. All cars are equipped with the vacuum automatic brake, and emergency passenger communication is arranged for on each.

The electric lighting is by means of the "L.M.S." single-battery system developed by L.M.S.R. engineers. One regulator, mounted on the underframe, controls the output of the dynamo in accordance with the lamp load and the condition of the battery, and maintains the lamp voltage within prescribed limits. Incorporated with this regulator are a cut-in switch and a magnetic lights switch. The latter can be operated by a sub-controller on the individual coach, or, except in the case of coaches carrying an attendant, by a master controller situated in the guard's compartment of each brake vehicle.

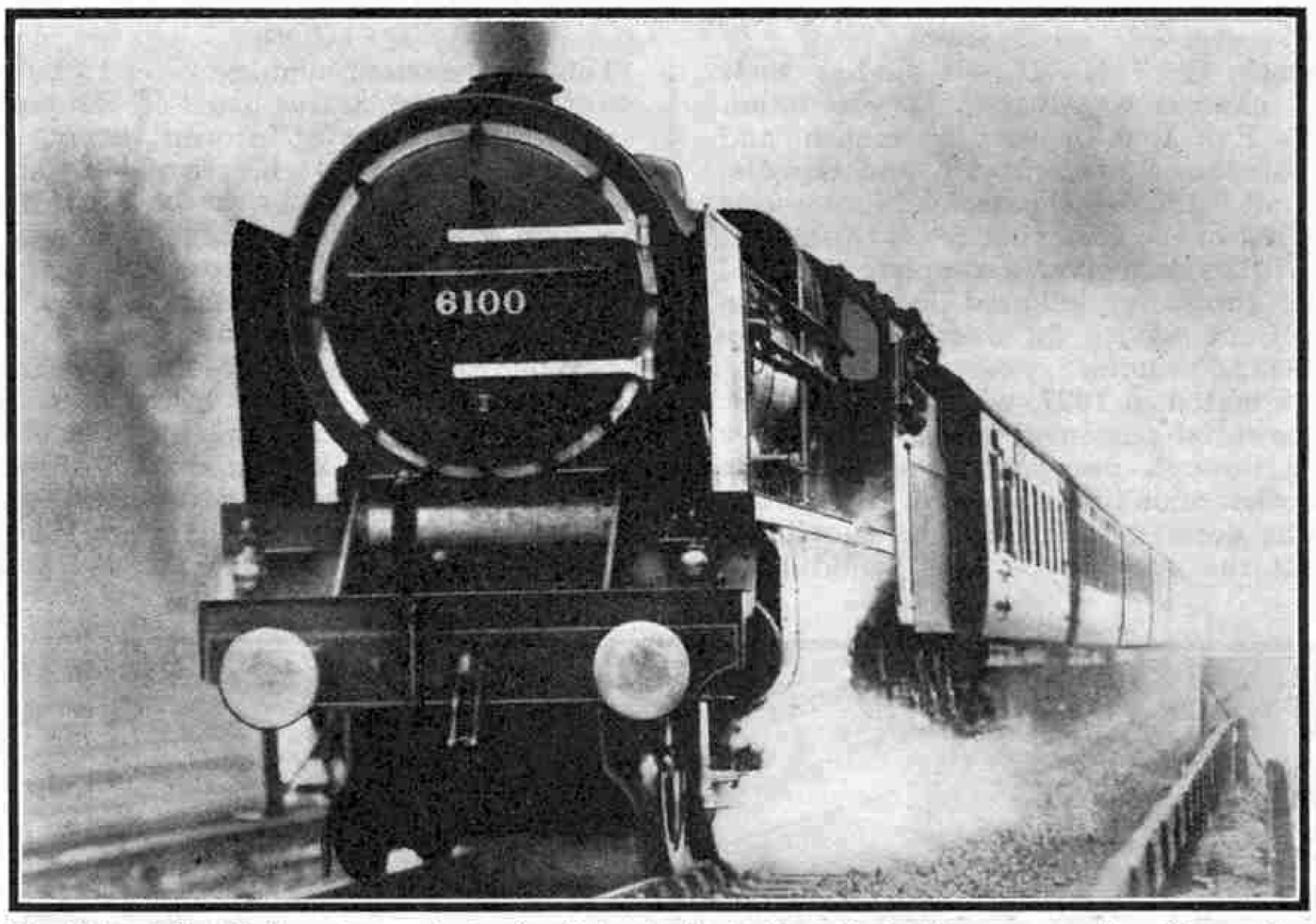
The corridor third brake car is one of the latest put into service by the L.M.S.R., and it embodies many new features, both in regard to exterior and interior finish. The body framing is of teak, the sides, ends and roof being sheathed with steel panelling. The exterior has been designed to give a streamline effect and flush finish, the glass being bedded up against the face of the steel panelling. In the upper portion of each compartment and corridor light a sliding extractor ventilator is fitted, so designed as to preserve the flush appearance given by the fixed light below, and to give the effect of forming an integral part of the light. The floor is made up of fireproof material laid on dovetailed steel

sheeting. Overhung suspended gangways are fitted.

The vehicle has four compartments, seating 24 passengers. Each compartment has four electric lights, two above each seat, and so arranged that the light is projected to the normal reading position, while at the same time direct light is screened from the passengers opposite. Each compartment also has two electric bell pushes, connected by through circuits to the attendant's compartment of the train.

The third-class vestibule dining car has two dining compartments, one for smoking and one for non-smoking passengers, and seating 24 and 18 respectively.

In the electric kitchen car the whole of the cooking is done electrically. The energy is provided by two Diesel engines of the compression ignition solid injection type, operating on the two-stroke cycle principle and running at 1,150 r.p.m. This type of engine dispenses with the customary valves in the combustion chamber, and effective clearance of the exhaust gases is secured by scavenging air pumps individual to the four cylinders. Direct coupled to each engine is a generator of 27 kW. capacity, operating at 115 volts D.C. Each engine and generator is arranged as a complete independent unit, with facilities for parallel running. The circulating water is cooled by a radiator through which air is drawn by two motor-driven fans. This air enters the engine room by vents in the roof and, after passing over the radiator, is discharged through the floor of the coach. A mechanically-operated governor adjusts the fuel supply in accordance with the load. The engines are housed in special compartments situated immediately over the bogies, so that their weight is carried in the most advantageous position. They are supported on hard felt foundations, and are not rigidly connected to any portion of the coach body.



The "Royal Scot" at work on a train of vehicles similar to those that will accompany it. The smoke deflector plates mentioned in the article are prominent at the side of the smoke-box.

Control of the generating plant is by push buttons from a switchboard in the kitchen under the charge of the cook. The engines are started electrically by current from the train-lighting battery, and all the functions of turning on the fuel supply, switching the generator on to the load, paralleling, etc., are performed automatically. The cooking range has a total loading of 67 kW.

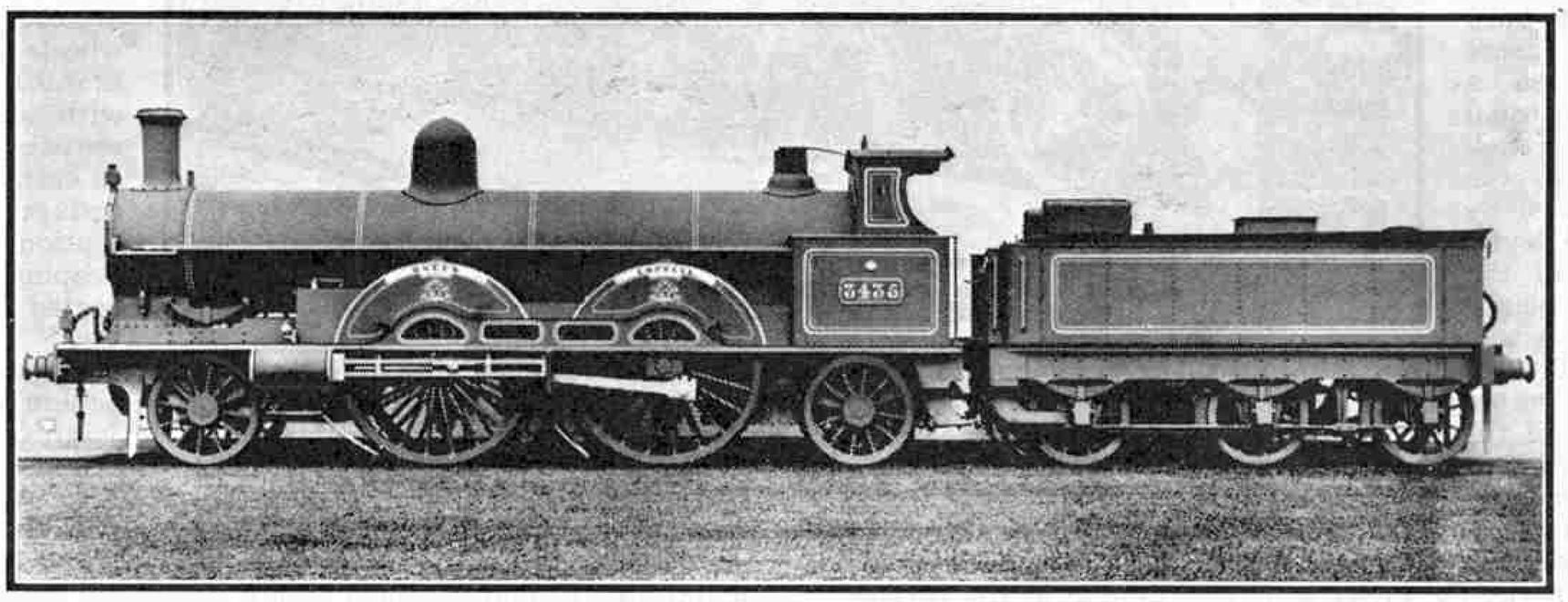
All circuits are controlled by three-heat rotary switches arranged with individual pilot lights along the top of the cooking range. An ammeter at the end of the range indicates to the cook when full load is reached on one engine and on both. If the generator should inadvertently be overloaded, resulting in the tripping of the main contactors, the cook can reset them by means of a push button on his switchboard, and without resort to any further operation.

The car has been designed to locate the power unit loads over each bogie. The kitchen is in the centre, and is equipped with a three-oven stove with two grills above; vegetable boiler; cold water tanks in the roof with a combined capacity of 230 gallons; hot water tank over the stove; two hot water urns; hot plate oven; sinks; wash draining boards; refrigerator, chopping block, and serving boards. The walls of the kitchen are lined with "Staybrite" steel.

The corridor first vestibule car is arranged to provide a first-class dining compartment for 18 passengers at one end, and three first-class corridor compartments at the opposite end seating 12 passengers. The dining compartment is finished in Indian greywood, with quartered panels with crossbanding and ebony inlay. The first corridor compartment is panelled in 16th century style in Old English oak, inlaid with bog oak and sycamore; the second is finished in a similar manner to the dining compartment; and the third is finished in Cuban mahogany, with quartered panels with crossbanding and satinwood inlay. The seats are fitted with loose cushions supported on lace web spring frames. Head rests and folding arm rests are provided, and the ends of the seats are formed to give a settee effect.

The first-class lounge brake car has one lounge compartment seating 10 passengers, and a brake compartment.

The third-class sleeper is the first car of a new type, solely for night use, to be put into service by the L.M.S.R. There are seven compartments, giving sleeping accommodation for 28 passengers. The body framing is of teak, finished on the outside with steel panels, and the exterior is designed to give a flush finish and balanced elevation. In order to eliminate track and running noises the floor is made up of cork sheeting $1\frac{5}{16}$ in. thick, laid on dovetailed steel sheeting. In addition, a blanket of insulating material is attached to the whole of the underside of the body floor. Each compartment contains four berths and entrance is by a sliding door. The interior fittings comprise a mirror on this door, a rack for light articles, coat and hat hooks, and a combined ascending ladder with table top. A recess for attaché cases, etc., extending over the corridor ceiling, is provided for the use of the upper-berth occupants. Each compartment has a 60-watt lamp with an orange-tinted Nacrolaque shade, and a blue night light is situated over the sliding door. These lights are so arranged that one or the other is always illuminated, and consequently the compartment is never in complete darkness. At the head of each bed is fitted a combined bell-push and reading lamp, the light from the latter reflecting into the berth, and thus not interfering with the other occupants of the compartment. The corridor lights can be dimmed by the attendant.

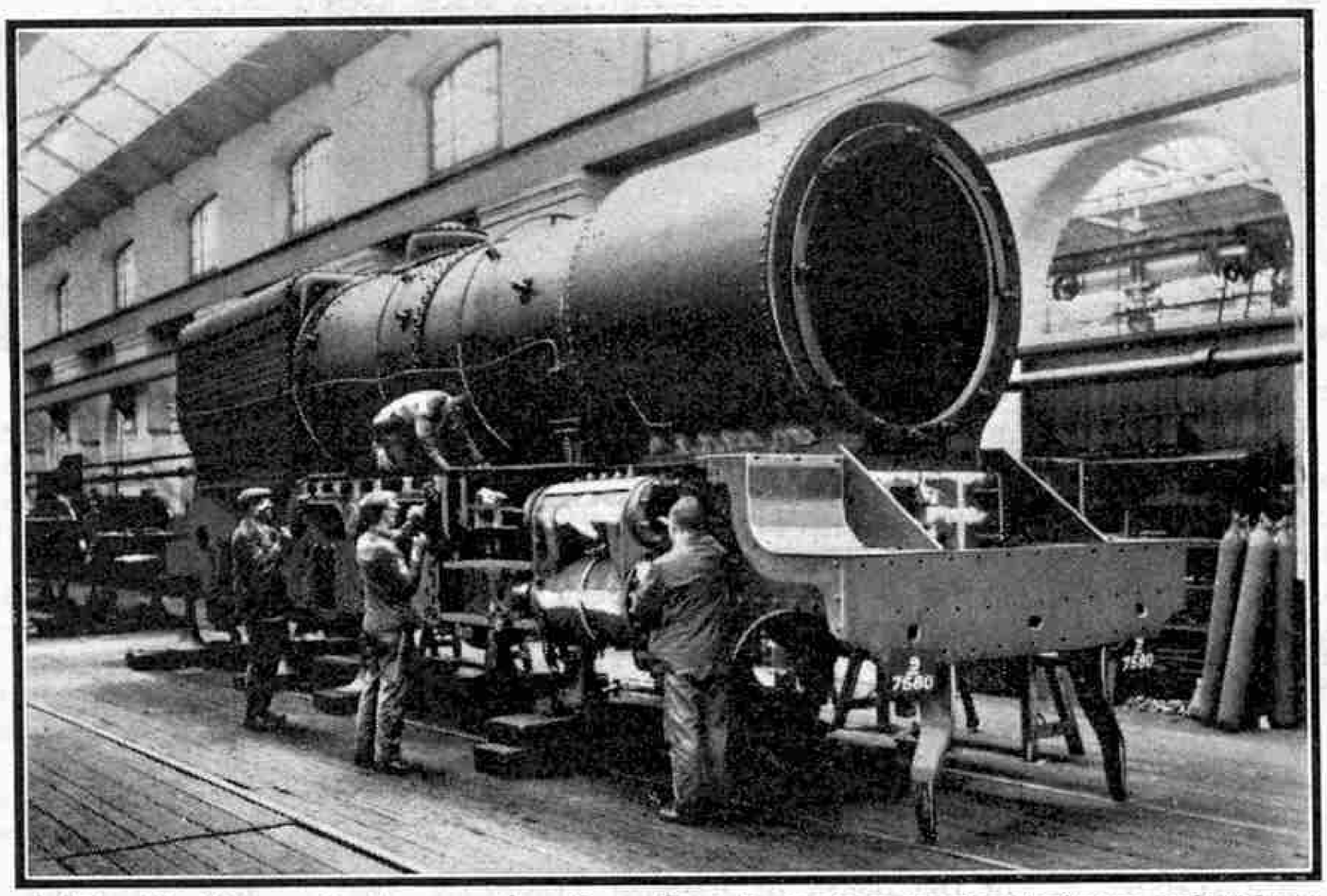


"Queen Empress," a locomotive of the former L.N.W.R. It gained a gold medal at the Exposition at Chicago in 1893, and in running 1,500 miles on American railroads anticipated the visit of "The Royal Scot" this year.

The compartments are heated by Westinghouse steam heaters, arranged along the body side and passing under the feet of the lower berths. The exposed portion is covered by a grill, Bowden wire control being provided. Three concealed heaters are fitted in the corridor. Air for ventilation is induced by means of scoops arranged along the corridor body side in series to suit the direction of travel of the car. After passing through oil filters, the air

enters the corridor at floor level and the compartments through grills fitted in the bottom of the compartment sliding doors. The latter are fitted with " hit and miss " slides, to allow of control by the passengers. In addition, sliding light extractor ventilators are fitted over each light on the compartment side, and roof ventilation is also provided. The attendant's compartment is fitted with a gas-heated hot water boiler for supplying water for tea, etc., with sink, draining board, and cupboards for crockery, glasses and provisions.

The first-class sleeper is of the side corridor type, with 12 single berths, eight of these being connected in pairs by a communicating door. The framing is of teak, with a steel panelled exterior and sill running the entire length of the car. Special consideration has been given to the elimination of track and running noises, both on the bogie and underframe. The space between the double floor, body sides and roof is filled with insulating material. Attention has been given also to the insulation of the dividing partitions and the prevention of creaking of the bodywork. Silent-type berth fans and switches are fitted. Felt discs are fixed to the intermediate pillars and rails to prevent drumming of the exterior steel panels against the body framing.



A " Royal Scot " locomotive in course of erection. The boiler has been placed on the frames, and workmen are preparing to fit up the pistons and valve motion generally.

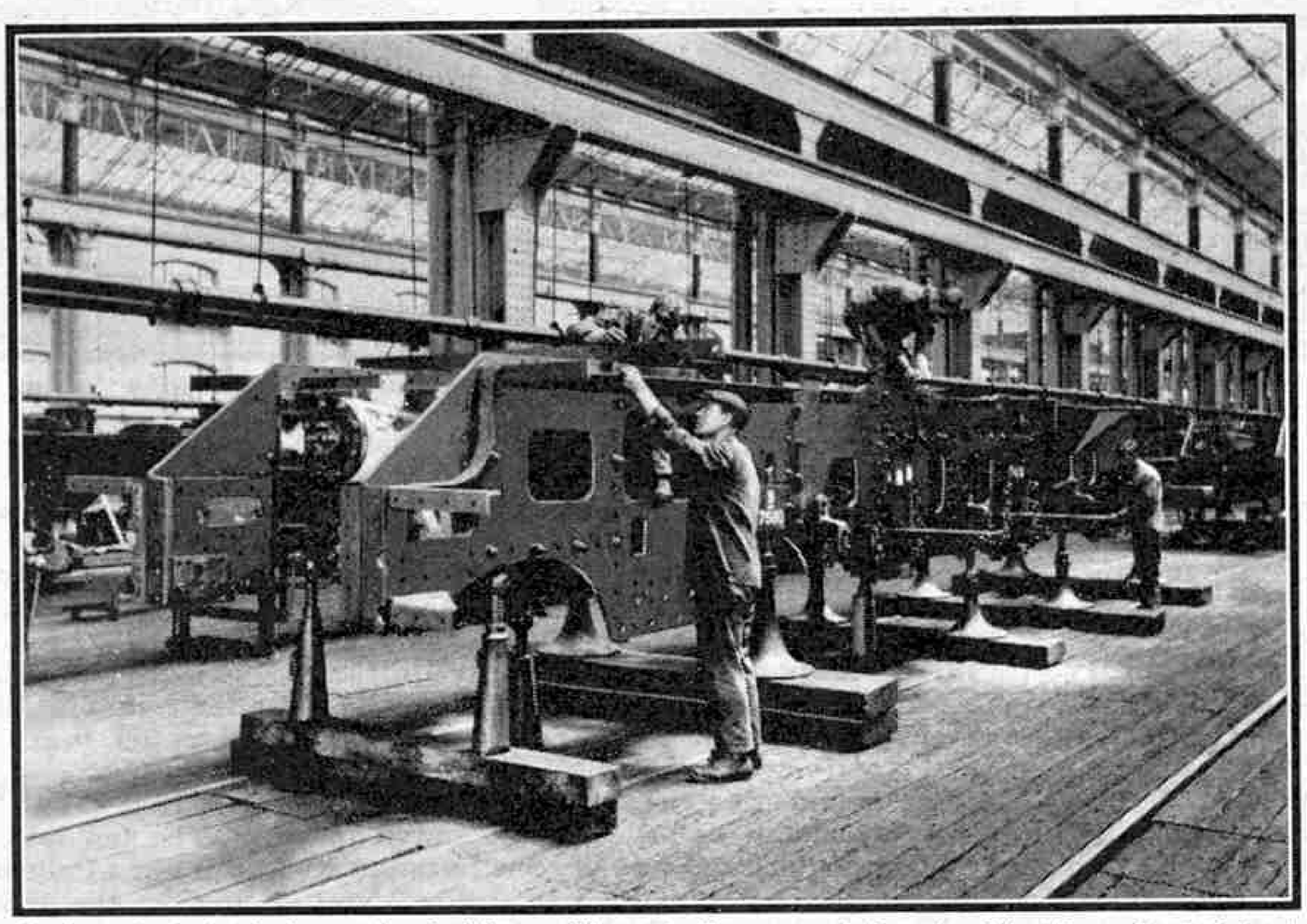
The berth compartments are finished in various designs, with furnishings and fitments to match. In several of the berths a bedstead effect has been obtained by fitting dummy bed heads. A frameless droplight with sliding shutter and louvre ventilator provides each compartment with additional ventilation to that supplied by the " Thermotank " system. The attendant's compartment is fitted with hot water urn and circulating boiler for supplying hot water to the berth wash basins, making tea, etc. For the convenience of passengers a letter box is fitted at the end of the corridor, and this is cleared by the attendant.

The electric lighting provides for a light over the mirror, a lamp for general illumination, and a reading lamp in the corner at the head of the bed. These lamps are controlled by special silent switches, arranged on a switch plate attached to the door pillar beside the bed. The reading light can be dimmed to serve as a night light, or may be completely extinguished. Incorporated in the switch plate is a bell-push to call the attendant.

Heating of the car is effected solely through the medium of the ventilating equipment, which consists of the " Thermo-Reg " system. An electrically-operated fan, fed from the train lighting equipment, draws air through a viscous oil filter, and passes it into the two ducts running the length of the corridor. The air to one of the ducts travels through a steam-operated heater, the temperature of which is under the control of the car attendant. In each berth, and in the attendant's compartment, there is a Punkah louvre connected by dual air trunks to the hot and cold air ducts in the corridor. This louvre is fixed over the head of the bed, and provides complete control of heat and ventilation, as well as of the direction of the air current. Entirely cold or hot air, or any mixture of the two, is available. Air circulation is secured by the provision of a louvred panel in the foot of the berth door, the usual torpedo vents in the roof being dispensed with. By means of valves under the control of the attendant any proportion of the air can be re-circulated. Facilities for control of the fan speed are also available, by which the velocity of the air can be adjusted as required.

The underframe, which is 68 ft. long over headstocks, is carried on six-wheeled bogies of the L.M.S.R. standard pattern, but with wood centre wheels to ensure more silent running. In order to eliminate track noises at the source, oil lubricating pads have been fitted to the centre castings and side friction blocks. The brake pull rods and safety chains are protected with leather washers at points where they are likely to rub or vibrate against underframe or bogie members—an interesting detail refinement.

The rear vehicle of the train, the first-class brake, consists of four first-class corridor compartments, seating 16 passengers. Three of these compartments are similar in design to those in the corridor first vestibule car already described. The additional compartment is finished in walnut, and upholstered in a shade of material to match. The metalwork is silver oxidised finish. The corridor sliding doors are of the double type arranged in conjunction with the corridor lights to give good window outlook. The corridor and lobby ends are finished in greywood panelling, and the floor is covered with Wilton carpet.



An important step in locomotive building. The main frames are being stayed together after being set accurately in the correct position.

As will be realised, the shipping of the complete train, weighing altogether 395 tons, was no mean feat, but the loading was completed without a hitch. The C.P.R. steamship " *Beaverdale*," with the train on board, left Tilbury early last month after five days had been occupied in loading. Special equipment was provided, and for the actual lifting the giant 150-ton crane " *London Mammoth* " of the Port of London Authority was used.

The locomotive was partly dismantled, the boiler, frames and wheels, and the tender, being stowed as separate units in the hold. The eight coaches were shipped as deck cargo, and tracks were laid down specially to accommodate them. The vehicles were secured in position, and all the paintwork was thoroughly coated with wax as a protection against the weather. On arrival at Montreal the preparation of the train for service was carried out in the C.P.R. shops.

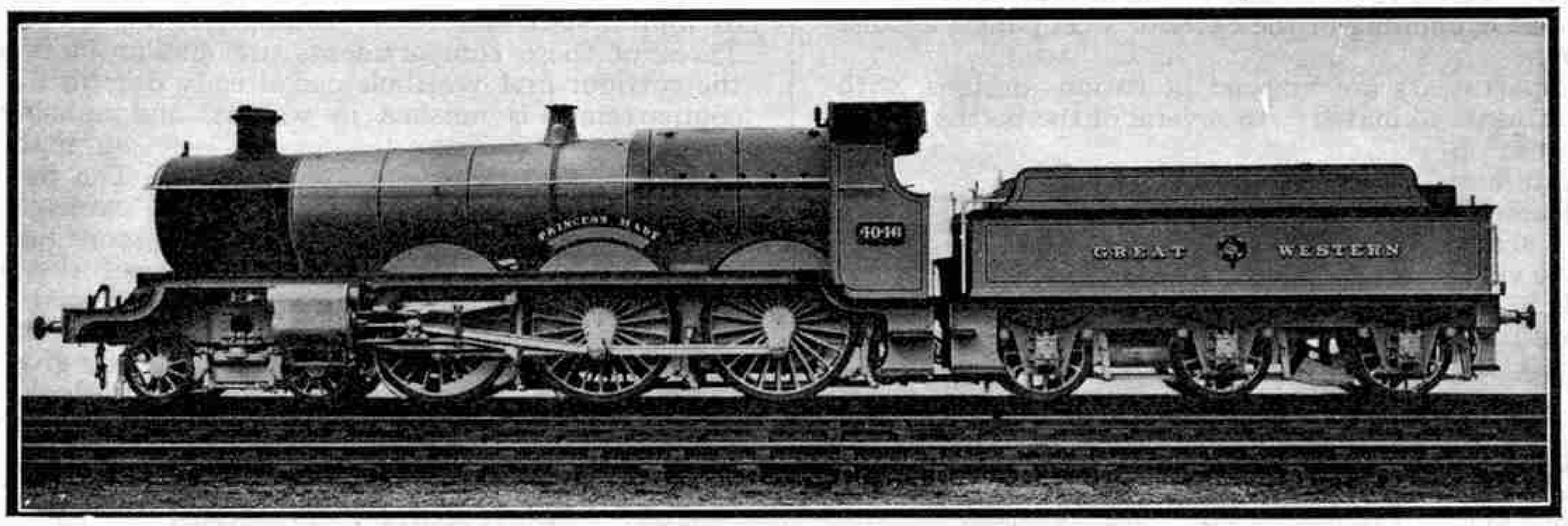
During this month it will cover 3,181 miles and will visit 39 cities, and after exhibition at the Chicago World's Fair a further 1,260 miles will be travelled with visits to 10 cities. The train will be worked throughout by an L.M.S.R. crew.

More "Baby Scots" on L.M.S.R.

New three-cylinder 4–6–0 engines of the "Baby Scot" (5X) class turned out from Crewe works are numbered 5952, 6006, 6008 and 6026. Of the batch of 10 similar engines now building at Derby, No. 5916 has been completed. These engines replace the "Claughtons" that formerly bore these numbers. Nos. 6008 and 6026 have been sent to Camden shed, so making a total of five "Baby Scots" now located there, the others being Nos. 5966, 5974 and 6010. In addition, five of the rebuilt "Claughtons" with four cylinders (also classed 5X) are shedded at Camden. Of "Royal Scots," 18 make their home at Camden. Two of these, No. 6127, "*Novelty*," and No. 6154, "*The Hussar*," have come there lately from Scotland (Polmadie, Glasgow, shed) in exchange for No. 6105, "*Cameron Highlander*," and No. 6115, "*Scots Guardsman*," that have gone to Polmadie. No. 6100, "*Royal Scot*" was a Camden engine, but at present, while away on exhibition service in the United States and Canada, it is in charge of a Carlisle crew, and so bears the number of their shed, 29.

The other express locomotives now stationed at Camden include eight ordinary "Claughtons" and eight 4–4–0 compounds of the "1100" series. The principal work of these compounds is on the London-Birmingham two-hour expresses, a task that they perform very competently. One of the "Birminghams" in each direction is now booked to be worked by a "Claughton," however, the particular trains being the 5.50 p.m. down and the 8.40 a.m. up. These are exceptionally heavy trains and the additional power of the 4–6–0 engine is often necessary if time is to be kept. It may be mentioned that the service slack at Brandon that has been in force for a considerable time past, owing to colliery subsidence, has now been taken off, to the decided relief of the enginemen on the Birmingham expresses.

Another interesting Camden engine working that has been instituted recently provides that the "Royal Scot" engine taking the 10.30 a.m. express from Euston to Liverpool shall return the same day with the "*Liverpool Flyer*," leaving Lime Street at 5.25 p.m. and making the run of 152.7 miles from Crewe to Willesden in 142 min. at an average of 64.5 m.p.h. This involves 400 miles a day and 2,400 miles a week of very fast running with trains of quite heavy loading, the highest speed of all being required at the end of each day. The first engine to be put regularly on this turn was No. 6116, "*Irish Guardsman*."



G.W.R. locomotive No. 4046, "Princess Mary," one of the later engines of the 4-cylinder "Star" series.

Trevithick Centenary Exhibition

In commemoration of the centenary of the death of Richard Trevithick, the authorities of the Science Museum at South Kensington, London, have arranged a special exhibition of a remarkably large and interesting collection of objects associated with the celebrated engineer. The exhibits include two of Trevithick's model locomotives; one of his high-pressure engines and the boiler and flue from another; his threshing engine of 1811; a portion of the Pen-y-Darran tramroad on which his South Wales locomotive ran in 1804; several of his note and account books, letters and other documents; contemporary drawings and engravings of his engines; and John Linnell's oil portrait and Francis Burnand's marble bust of Trevithick.

The exhibition, which is in the main hall of the Museum, was opened on 31st March and will be continued until the end of June. All readers of the "*M.M.*" who can visit the Science Museum and inspect this special Trevithick collection will be well advised to do so.

New Light Rail Car for the S.R.

A Sentinel-Cammell steam rail car of a new type has been purchased by the S.R. and put into service on the short branch line between Brighton and The Dyke. Although the car is much lighter than the usual standard type, it is fitted with a 100 h.p. compound engine in view of the fact that the line is an exceptionally difficult one, climbing as it does almost to the top of the South Downs and having a ruling gradient of 1 in 40-41 for about three miles.

The engine boiler is of the vertical "Sentinel" type with a pressure of 325 lb. per sq. in. It is placed in the driver's compartment at one end of the car and is equipped with a feedwater regulator and a mechanical stoker, both of which are automatic in action and make the services of a fireman unnecessary. The car can be operated from either end and at the end opposite to the one where the boiler is placed, the driver's compartment also provides accommodation for luggage. Entrance to the car is by means of doors placed about the middle of the car, one on each side. Seating is provided for 44 passengers. The length of the car is 48 ft. 4 in. and its width is 8 ft. The weight of the rail car when fully loaded is 20 tons 5 cwt.

The rail car made the journey from the makers' works at Birmingham to Brighton under its own steam on Sunday, 19th March, travelling via Northampton and Willesden. Birmingham was left at 7.15 a.m. and Brighton was reached at 3.8 p.m. The running throughout was very comfortable and a speed of more than 60 m.p.h. was attained.

S.R. Pullman Car Names

The new 1st Class and composite 1st and 3rd Class Pullman cars that are now operating on the "Southern" electric services between London and Brighton and Worthing are all adorned with names. For the 1st Class cars of the three "*Southern Belle*" units the chosen names are:—"*Doris*" and "*Hazel*"; "*Audrey*" and "*Vera*"; "*Gwen*" and "*Mona*." On the other express services, 23 composite cars are engaged and these bear names as follows:—"*Alice*"; "*Anne*"; "*Bertha*"; "*Brenda*"; "*Clara*"; "*Daisy*"; "*Elinor*"; "*Enid*"; "*Ethel*"; "*Grace*"; "*Gwladys*"; "*Ida*"; "*Iris*"; "*Joyce*"; "*Lorna*"; "*May*"; "*Naomi*"; "*Olive*"; "*Peggy*"; "*Ruth*"; "*Rita*"; "*Rose*"; and "*Violet*."

High Steam Pressures on German Railways

Engines of several different types have been built lately for the German State Railways with boilers that carry the exceptionally high working pressure of 355 lb. per sq. in. Unlike most of the high-pressure locomotives built in recent years, however, these engines have boilers of the normal locomotive type and not of special design. The use of the higher pressure has been made possible by constructing the boilers of special alloy steels which, while not increasing the weight, give the strength necessary to carry safely the higher pressure.

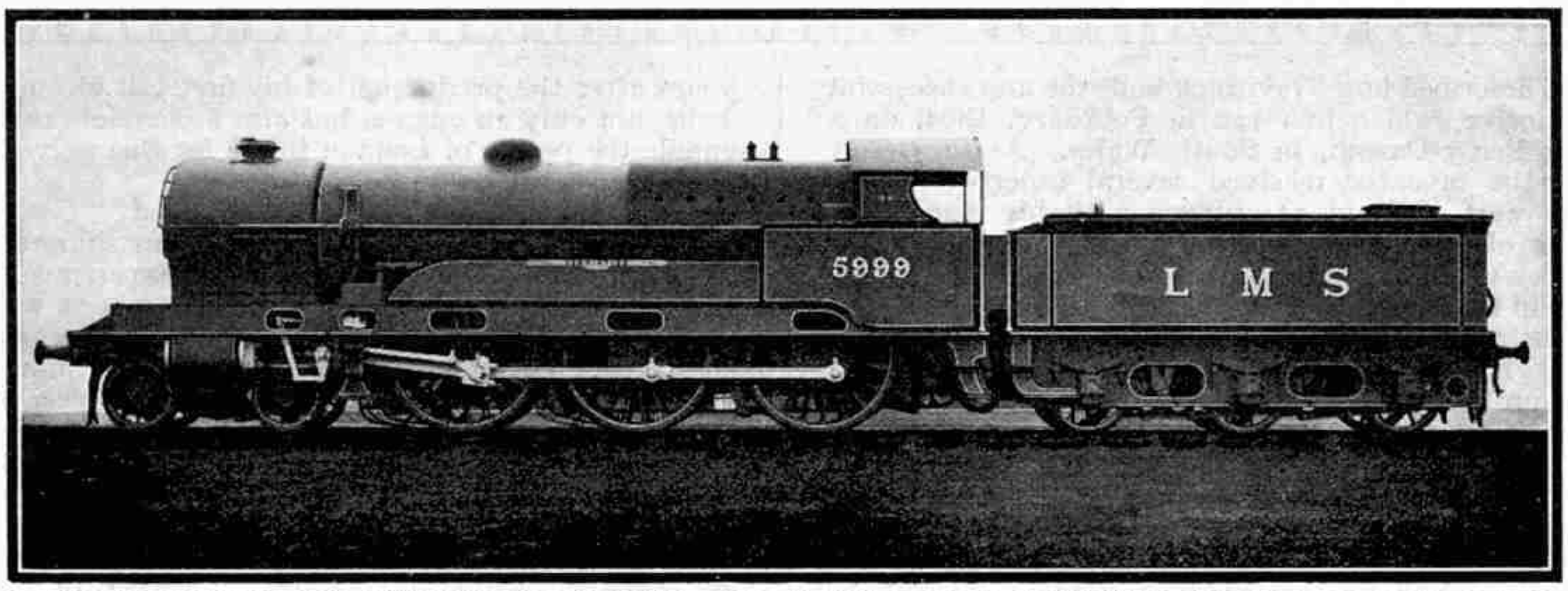
Chief among these high-pressure locomotives are some fine four-cylinder compound "Pacifics" for the fastest and heaviest express work and some very powerful four-cylinder compound freight engines having the 2–10–0 wheel arrangement. Several smaller 2–6–0 engines have also been provided with boilers suitable for carrying the same high pressure.

Named Engines on L.N.E.R. West Highland Service

Darlington works have completed two further 4–6–0 engines of the "Sandringham" (B.17) class. They are :—No. 2838, "*Melton Hall*," and No. 2839 "*Rendelsham Hall*."

Names have been given to 13 2–6–0 engines of the K.2 class that are now engaged on the West Highland Service. These are as follows :—No. 4674, "*Loch Arkaig*"; No. 4682, "*Loch Lochy*"; No. 4684, "*Loch Garry*"; No. 4685, "*Loch Treig*"; No. 4691, "*Loch Morar*"; No. 4692, "*Loch Eil*"; No. 4693, "*Loch Shiel*"; No. 4697, "*Loch Quoich*"; No. 4698, "*Loch Rannoch*"; No. 4699, "*Loch Laidon*"; No. 4700, "*Loch Lomond*"; No. 4701, "*Loch Laggan*"; and No. 4704, "*Loch Oich.*"

Mr. Wm. Whitelaw, chairman of the L.N.E.R., stated recently that owing to the reduction in business there was no need for the building of either new engines or wagons on any extensive scale. He said that since the end of 1928 the Company's stock of steam locomotives had been reduced by 332 and yet they now had 430 locomotives out of commission and tallowed down.



L.M.S.R. locomotive No. 5999, "Vindictive," a rebuilt "Claughton." This was the first of the "Claughton" class to be given a larger boiler and 19 others have been similarly rebuilt. Caprotti valves and valve gear have been fitted to 10 of these.

Accelerations on the S.R.

In addition to the acceleration of the 3 p.m. express from Waterloo to the West of England, reported in the "*M.M.*" for March last, another notable quickening has been made by reducing the timing of the 1.30 a.m. newspaper train from Waterloo to Plymouth. For the 88 miles of mountainous road between Salisbury and Exeter only 94 min. are now allowed, demanding an average speed of 56.2 m.p.h. In view of the extremely severe gradients, this run calls for locomotive performance of the very highest order.

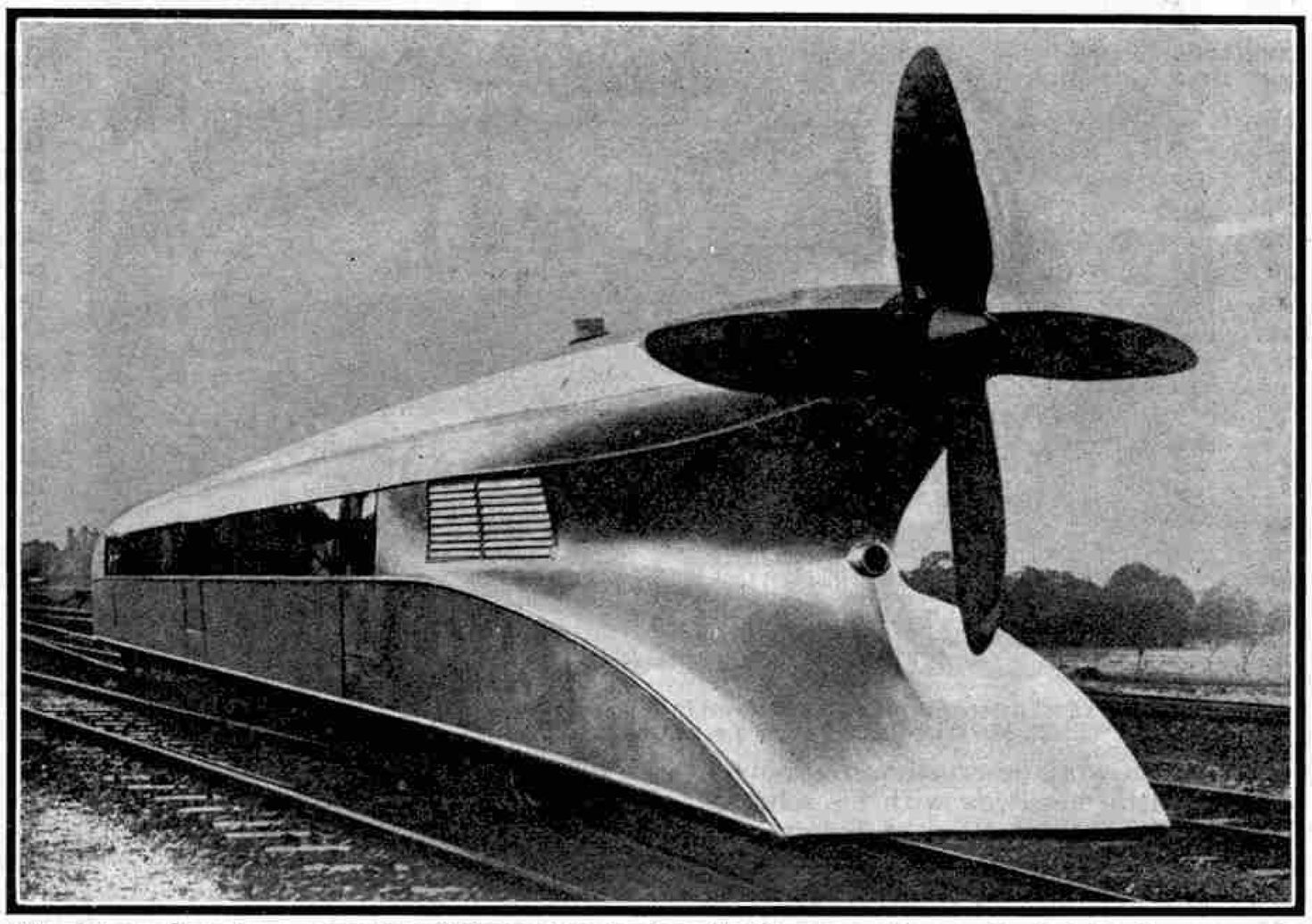
Reviewing these accelerations, a writer in the "*Southern Railway Magazine*" suggests that the S.R. might "go one better" and put on an express to make the journey from Waterloo to Exeter in the even 3 hours; 83 min. being allowed for the 83¾ miles from Waterloo to Salisbury, giving what the S.R. has not yet attained, a magic mile-a-minute booking. After a 4 min. stop at Salisbury, an allowance of 93 min. thence to Exeter would give an overall time of 3 hours from London to the "ever-faithful city." Such a timing could be made more easily of course if track troughs were laid down for taking water en route and the Salisbury stop eliminated. For some reason, however, the railways comprised in the "Southern" have never adopted water troughs, although, strangely enough, a 4-cylinder 4–6–0 engine, No. 335, that was built by the L. & S.W.R. in 1907, was given a tender equipped with water pick-up gear.

C.W.R. to Run Air Services

On Wednesday, 12th April, the G.W.R. inaugurated a regular daily Air Service between Cardiff and Torquay and Teignmouth (Haldon Aerodrome). This is the first occasion on which any English railway has exercised the powers obtained from Parliament in 1929.

The flight takes approximately 45 minutes against a train time of four hours. The fares have been fixed at the low figure of £3 single and £5 return, and passengers have the additional facility of having their heavy baggage collected, conveyed by rail, and delivered at destination without extra charge. Imperial Airways Limited are supplying a 3-engined Westland Wessex 6-seater plane with one of their most experienced pilots, and all necessary ground staff. The plane is painted in the G.W.R. Company's colours, chocolate and cream, and the interior upholstery is similar to that used in a first-class compartment. It is probable that the service will be extended to Plymouth and St. Ives during the Summer.

It is interesting to recall that the S.R. have an interest in Imperial Airways.



The Railway Zeppelin, an experimental locomotive developed in Germany. Its propeller is driven by means of a Diesel engine and during a special test the vehicle ran from Hamburg to Berlin at an average speed of more than 100 m.p.h., the maximum being 142 m.p.h.

G.W.R. Locomotive News

At Swindon, work is proceeding rapidly on a new lot of 10 standard 4–6–0 engines of the "Hall" class and it is expected that all will be in traffic by the end of May. These engines will have many minor improvements on the earlier engines of this class. The numbers and names of the new engines are :—No. 5921, "*Bingley Hall*"; No. 5922, "*Caxton Hall*"; No. 5923, "*Colston Hall*"; No. 5924, "*Dinton Hall*"; No. 5925, "*Eastcote Hall*"; No. 5926, "*Grotrian Hall*"; No. 5927, "*Guild Hall*"; No. 5928, "*Haddon Hall*"; No. 5929, "*Hanham Hall*"; and No. 5930, "*Hannington Hall.*"

Trevithick—Father of the Locomotive

II.—World's First Passenger Railway

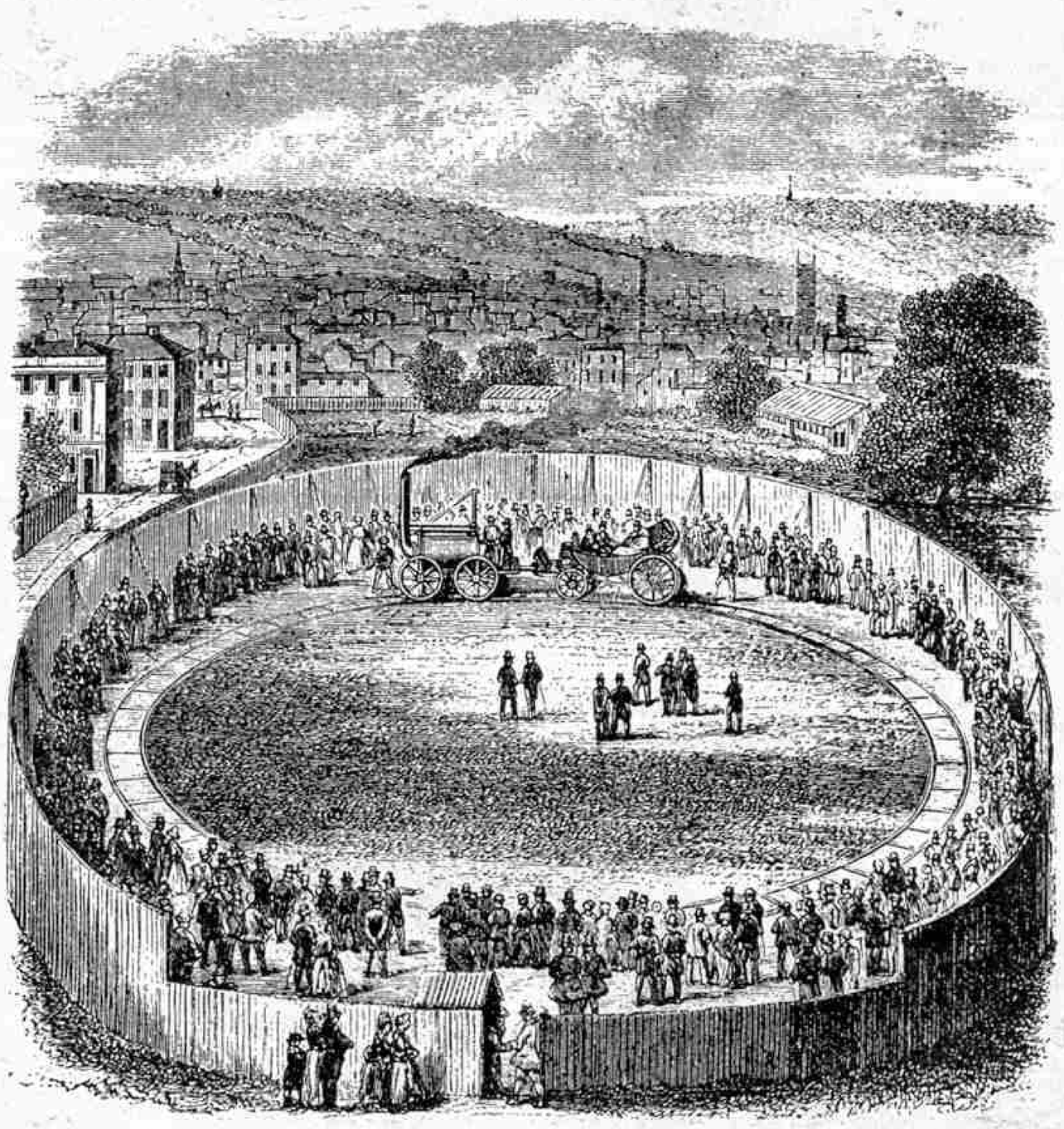
LAST month we described how Trevithick built the first successful steam locomotive, which first ran in February, 1804, on a plateway at Pen-y-Darran, in South Wales. As the result of this triumph the inventor received several orders for locomotives. Others were built in accordance with his plans, and one of these was of special importance, for it provides a link between Trevithick's pioneer experiments and the development of the locomotive in the North East of England, the native country of the Stephensons and other railway engineers who later were to become famous. This was a locomotive constructed in a Gateshead foundry in 1804, probably by a mechanic named Tommy Waters, a well-known Tyneside character, who at a later period is said to have held down the lever of the safety valve of an obstinate steam engine that refused to work, declaring in desperation that "either he or she would go!"

The Tyneside engine was similar to the Pen-y-Darran locomotive, but the cylinder was at the rear of the boiler instead of at the front. It was built for Mr. Blackett of Wylam, and was tried on a temporary railway laid down in a small yard, in the presence of many north-countrymen interested in the development of railways, chiefly in association with colliery working. Its capabilities were shown by the manner in which it ran backward and forward, always under perfect control, and undoubtedly it was a better engine than the one built at Pen-y-Darran. An interesting feature was that the four driving wheels were constructed to run on rails instead of on plates. Although successful in the trials, the engine never left the works in which it was built, probably because of a disagreement between the maker and Mr. Blackett; and it continued to be used in the foundry as a stationary engine.

Unfortunately Trevithick's hopes of reaping the reward his work deserved were doomed to disappointment, and he made little headway with his schemes for making and selling locomotives. This is typical of Trevithick's inventions, for it is remarkable that none of them seemed to lead to immediate developments. The explanation is probably to be found in the character of the inventor. As an engineer he was a genius, capable of seeing instantly how things should be done and of designing means of doing them that were at once remarkably simple and highly effective. He lacked the dogged perseverance of a Stephenson, however, and the result was that his inventions were never developed sufficiently to bring him the reward that undoubtedly was his due.

A further obstacle in the way of Trevithick's advancement was the enormous range of his interests. His energies were dissipated over many schemes, in all of which he showed wonderful skill and inventive ability, but seldom carried them through to a successful conclusion. At one time there was a possibility of his settling in South Wales in order to concentrate on the production of locomotives. If he had done so there is no doubt that his genius would have developed railways in this country more than 20 years ahead of the time when they became practicable, for less than four years after the production of his first rail locomotive he actually built, not only an engine, but also a complete railway, in order to enable the people of London to see for themselves how they could travel in the future.

Trevithick's new engine was named "*Catch-Me-Who-Can*," and its wonderful simplicity and efficiency showed how well he had absorbed the lessons of his previous experience. He knew now that the friction of one pair of driving wheels was sufficient, and therefore he was able to dispense with the gear couplings previously employed. His steam blast also had been made more efficient, and had so greatly increased the steaming power of his locomotive that he had to place a damper in the chimney to check the draught. The locomotive itself weighed about 10 tons, and it careered at what was then considered the amazing speed of 12 m.p.h. round a circular track consisting of rails laid down on heavy baulks of timber. The inventor himself was convinced that it was capable of 20 m.p.h. on a straight railway.



The world's first passenger railway, laid down in 1808 near Euston by Trevithick. The locomotive, "Catch-Me-Who-Can," hauled a carriage round the track at a speed of 12 m.p.h.

Trevithick's experiment was carried out near Euston, on a site not far from the place that eventually was to become the terminus of the London and Birmingham Railway, and the first great railway station to be built in London. A charge of a shilling was made for admission to the enclosure, and those who were not too timid were privileged to ride in an open carriage hauled by the locomotive. Disaster eventually overtook the novel enterprise, however, for money did not come in very freely, and after the breaking of a rail had caused the engine to fly off at a tangent and to overturn, it became impossible to proceed further.

While this remarkable railway was in operation, Trevithick was busily engaged on schemes for adapting his high pressure steam engine to driving rock drills, propelling ships, unloading cargoes and many other purposes. Shortly after its abandonment he was engaged upon the first attempt to bore a tunnel under the Thames. The task set him was to drive a preliminary shaft under the river, and he brought miners from Cornwall to carry out the work under his direction. Unfortunately the driftway passed through quicksands and the inrush of water put an end to the scheme.

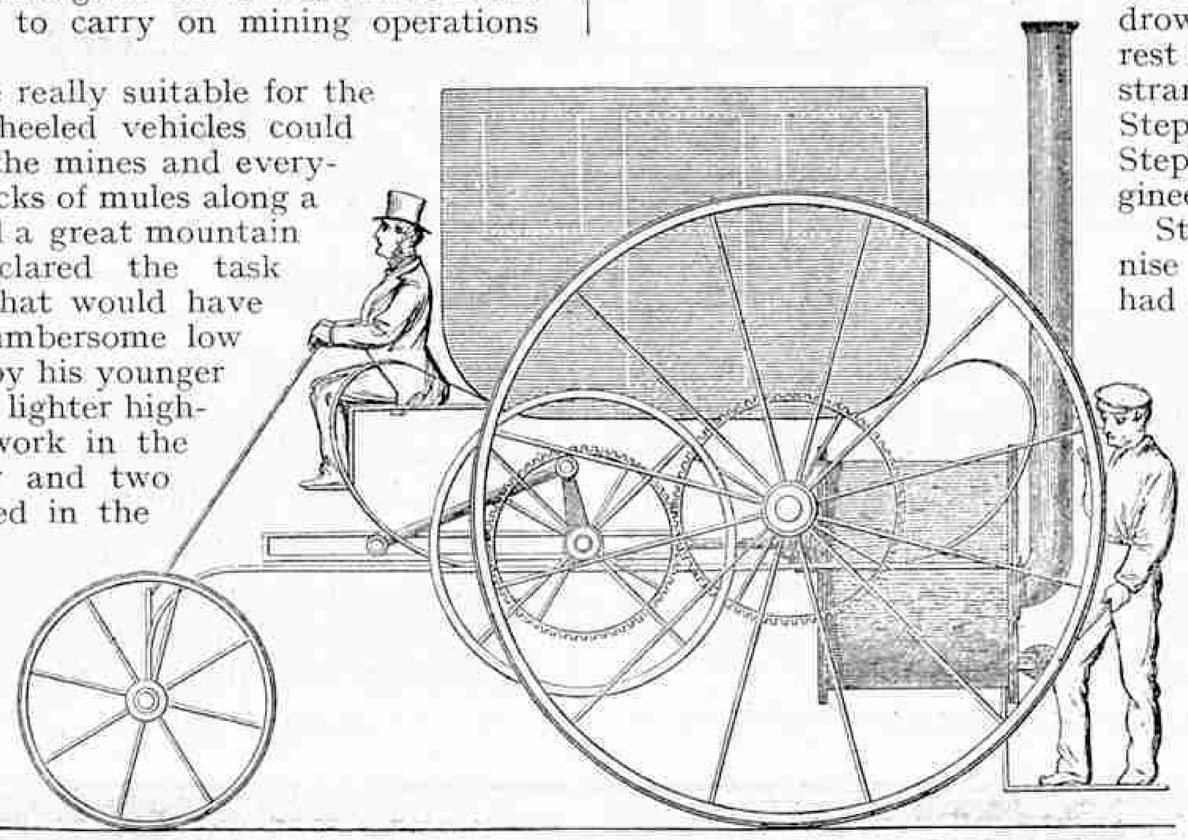
Trevithick was now in difficulties, for none of his schemes were successful, and ill-health also helped to restrict his activities. He returned to Cornwall, but the mining industry of his native county had fallen on evil days and no longer offered him good openings for exercising his genius. He continued to build and test pumping engines, however, and to think out schemes for new uses for high pressure engines. For instance, he constructed a steam threshing machine and a steam plough, and was so convinced of the value of steam power in every branch of agriculture that he said it would "double the population of the United Kingdom and make our markets the cheapest in the world."

Then came what seemed to Trevithick a wonderful opportunity of making a fortune in the silver mines of Peru. Cornish mining engineers were already famous throughout the world, and it is

no exaggeration to say that from this time onward Cornishmen were found wherever mining of any kind was carried on. The Peruvian mines in which Trevithick became interested were about 170 miles from Lima, the famous South American port, and at a height of about 13,000 ft. above sea level. In the past they had been amazingly productive, and still contained vast stores of silver, but the inrush of water threatened to make them useless. Trevithick boldly undertook the task of supplying his high-pressure pumping engines, and in return for a partnership in an enterprise that offered rich rewards he agreed to go to South America in order to supervise their erection and to carry on mining operations generally.

Only Trevithick's engines were really suitable for the task he had undertaken, for wheeled vehicles could not be used on the one road to the mines and everything had to be carried on the backs of mules along a very dangerous track that crossed a great mountain range. James Watt had declared the task impossible, but the difficulties that would have prevented the passage of his cumbersome low pressure engines were overcome by his younger rival, and four of the smaller and lighter high-pressure engines were soon at work in the mines, two pumping out water and two raising ore. A fifth was installed in the Mint at Lima, where it was instrumental in producing millions of coins for the Peruvian Government.

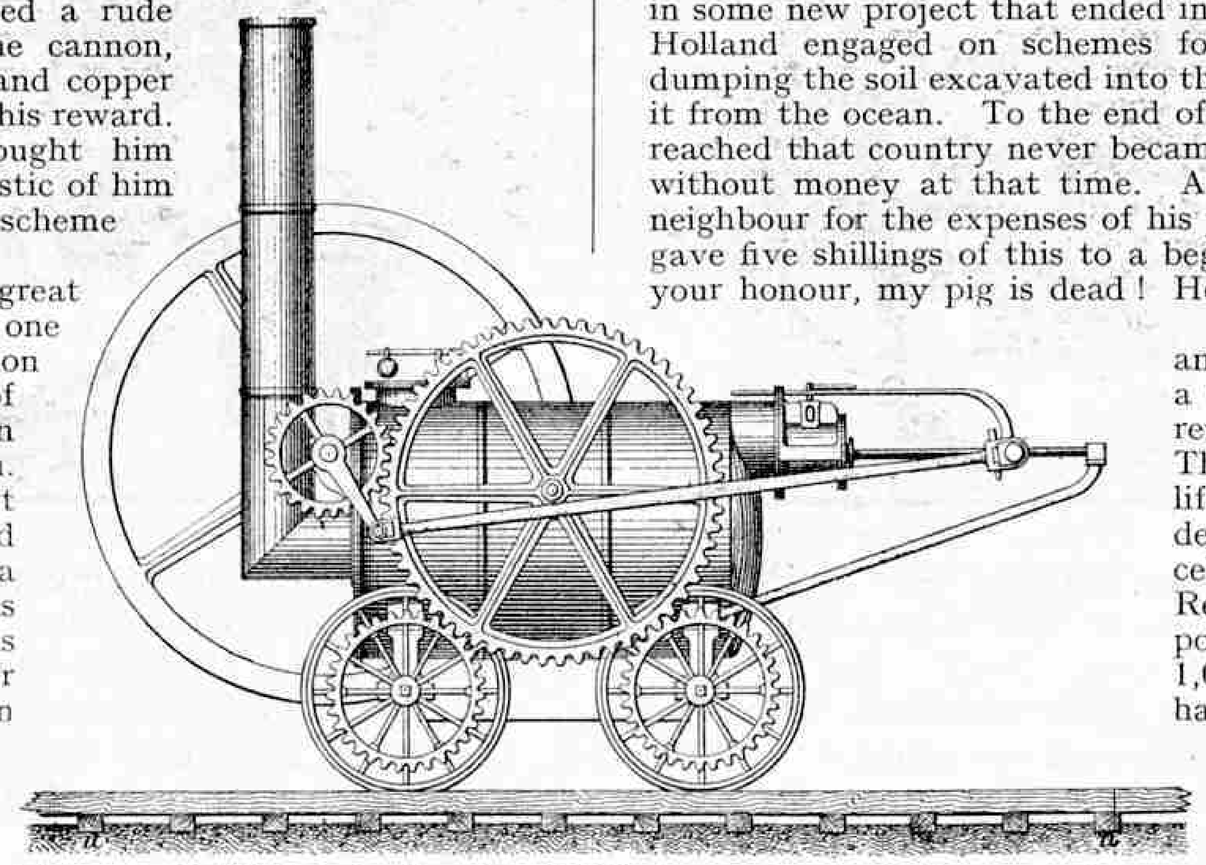
Unfortunately Trevithick's adventure, which was to make his fortune, turned out to be one of the greatest mistakes of his life. The jealousy and lack of principle of his associates ruined the enterprise, in spite of Trevithick's inventive genius and restless activity, and in the end he became completely disgusted and retired from the undertaking. The outbreak of the war in which Peru won independence from Spain eventually led to his departure from South America, his hopes of making a fortune completely frustrated.



The road locomotive that Trevithick tried in London in 1803. Runs of 10 miles were made through the streets and the locomotive was capable of 8.9 m.p.h.

A curious incident of Trevithick's stay in South America was his recovery of a large number of brass cannon from a wooden frigate that had sunk a few miles south of the Port of Callao. Trevithick constructed a rude diving bell and brought up the cannon, together with a quantity of tin and copper that he had stipulated should be his reward. This successful speculation brought him about £2,500, and it is characteristic of him that he lost it all in a crazy scheme for pearl fishing at Panama!

Trevithick was treated with great consideration in Peru, and at one time lived for months with Simon Bolivar, the great liberator of Spanish South America, then Republican Governor of Peru. When Bolivar's cavalry were short of firearms Trevithick invented and produced a carbine with a short barrel for their use. His success in this respect led to his enlistment in the army in order to prove the efficiency of his own gun, but later he was allowed to return to his engineering and mining projects. He had scarcely done so when the Spanish troops gained the ascendancy and drove him away.



A locomotive built in Gateshead from Trevithick's plans shortly after the inventor's triumph at Pen-y-Darran.

Trevithick left Peru about 1821 and made his way to Costa Rica, in Central America, hoping to gain a fortune from the new gold and silver mines near the Pacific coast of that country. He remained there about six years, surveying mines and making suggestions for improved methods of working, but did not realise the fortune he had anticipated, and eventually he set out to cross Central America to the Atlantic shore.

The way was practically unexplored, and passed through wild and difficult country, abounding in dense forest, treacherous swamps and torrential rivers, and the inventor and other members of his party had a narrow escape from starvation and endured great hardship. On one occasion during the journey Trevithick was compelled to jump into a dangerous river in order to reach safety after his raft had been carried away by the current. He could not swim, but he succeeded in getting hold of the leaf at the end of the stem of a water plant held out to him from the shore. On that leaf his life depended. Fortunately it was not torn from the stem, and he reached the shore safely.

This hazardous journey was not the end of Trevithick's adventures in the New World, for shortly afterwards he had a narrow escape from being eaten by alligators when his boat was overturned at the mouth of the river Magdalena in Venezuela, only avoiding this fate by being hauled ashore by means of a lasso. He was taken to Carthagena to recover, and there, while in a sombre mood after being, in his own words, "half-drowned and half-hanged, and the rest devoured by alligators," he had a strange encounter with Robert Stephenson, the son of George Stephenson, the famous railway engineer.

Stephenson at first did not recognise Trevithick, who recalled that he had nursed the younger man many a time when in the north of England in connection with the making of his locomotives. After Stephenson had learned his identity, the two had a long talk, and eventually Stephenson gave Trevithick £50, half of his own store of money, in order to enable him to reach England. Stephenson himself had been advising on engineering projects in South America and was then on his way home, where he and his father built the Liverpool and Manchester Railway and made sure that steam locomotives would be used on it. Thus by a strange coincidence the real inventor of the locomotive, and one of the two men who did most to introduce it, met accidentally thousands of miles from their native country.

Trevithick was now nearly 60 years of age, but he retained his old inventiveness and energy. Unfortunately he had not learned to carry through his work with the dogged perseverance of more successful engineers, or to be more businesslike, and he had been forgotten during his long absence in America. The result was that he continued to live in poverty, although almost always engaged in some new project that ended in failure. At one time he was in Holland engaged on schemes for cutting drainage canals and dumping the soil excavated into the Zuyder Zee in order to reclaim it from the ocean. To the end of his life the manner in which he reached that country never became clear to his family, for he was without money at that time. Actually he borrowed £2 from a neighbour for the expenses of his journey but almost immediately gave five shillings of this to a beggar who said to him: "Please your honour, my pig is dead! Help a poor man."

In 1830 his health broke down, and efforts already begun to obtain a Government grant for him were renewed, but without success. The few remaining months of his life were partly devoted to the design of a national monument to celebrate the passing of the Reform Bill in 1832. He proposed to erect a cast iron column 1,000 ft. in height. This was to have a weight of about 6,000 tons, and a lift operated by a high-pressure steam engine was to carry visitors to the summit. Trevithick's great tower would have been twice the height of the Great Pyramid, and would have topped the Eiffel Tower by 16 ft. If it had been built then, or in 1862, when its erection as a monument to the Prince Consort was suggested, it would have been of record height until the completion of the Chrysler and Empire State Buildings recently erected in New York.

Trevithick died at Dartford on 22nd April, 1833, after a week's illness. He was penniless, and as no relatives were with him, the expenses of the funeral were borne by mechanics from a neighbouring engineering works in which he had made experiments with a tubular boiler for marine engines. He was buried in an obscure grave that carried no stone or mark to show that it covered the remains of the inventor of the steam locomotive, whose work completely revolutionised transport, and whose introduction of the high-pressure steam engine added immeasurably to the wealth and productivity of the world.

XLII.—A STOCKBROKER

THE profession with which we are to deal this month is of great importance, the scenes of its activities being the Stock Exchanges of London and other cities. In these Exchanges, shares in industrial organisations, and the stocks of nations, counties, cities and large corporations, are bought and sold on behalf of the members of the general public who wish to acquire or part with these securities.

The London Stock Exchange is a famous building in Threadneedle Street. None but members of the Stock Exchange itself and a limited number of their clerks are allowed in the building, and it is claimed that no photographs of its interior have ever been published.

The London Stock Exchange, Throgmorton Street.

In the early years of the 18th century dealers in stocks and shares in London met in coffee houses in order to transact business, one of their favourite meeting places being Garraway's coffee house in 'Change Alley. As business expanded, a definite place in which to carry on operations became desirable and finally the Stock Exchange was established. This has developed and grown until to-day the company controlling it has more than 5,000 members, who every year deal in about 9,000 different securities.

Many of the early members of the Stock Exchange undertook other business in addition, but before long this was forbidden. Stringent rules govern proceedings generally, including the commission paid for transactions carried out, and ample safeguards are demanded from members in order to ensure their ability to meet all demands made on them by clients or by fellow members. A further important rule is that members must not advertise. They are only allowed to receive and carry out instructions from and on behalf of their own clients, and any individual or firm issuing circulars or advertisements of any kind to anyone else has no official standing and is not a member of the Stock Exchange.

Members of the Stock Exchange are divided into two classes, known respectively as stockbrokers and stock jobbers, those of the second class being usually described as dealers. A stockbroker is a member who is in touch with the general public and buys or sells stocks and shares on behalf of clients. A jobber buys and sells on his own account. He usually specialises in certain groups of stocks or shares and when a broker has business to transact on behalf of a client he approaches a jobber who deals in the securities concerned and asks him to quote a price. The jobber then gives the figures at which he will buy or sell, and if his terms are satisfactory the transaction is quickly concluded. Settlement day comes about once a fortnight and then all shares bought during the "account," as each period of dealing is called, must be paid for unless special arrangements are made to carry them over to the next account.

The Stock Exchange offers a very interesting field of work to a well-educated and ambitious boy, whether he becomes a broker or a jobber. However, it must be emphasized at the outset that capital is required in order to ensure success. Unless a candidate for admission has served as an authorised clerk to a member, he must acquire at least three shares in the Stock Exchange Company, and must purchase a nomination from a member who wishes to retire or from the representatives of one who has recently died. His outlay is further increased by large entrance fees and deposits, and there is also a substantial annual subscription.

Candidates must be at least 21 years of age and must be recommended by three members, and on entry they must choose between broking and jobbing. A curious feature is that they must be re-elected annually by the Committee. The purpose of this is to give the Committee power to exclude members who for any reason are no longer thought desirable members, and they exercise this power for the benefit of the Stock Exchange as a body.

As already noted, valuable concessions are made to candidates who have served as Authorised Clerks. Membership of the Stock Exchange may be secured without

The vicinity of the London Stock Exchange is a scene of great excitement when important financial measures are being taken, and the above photograph was taken in Throgmorton Street on the morning following the news of the decision of the Government to suspend the Gold Standard on 21st September, 1931.

service of this kind, but it is generally agreed that the best means of becoming familiar with the work carried on is to enter a broker's office. This step brings the novice into touch with all sides of the profession, for the broker deals with the jobber on the one hand and with members of the outside public on the other. Even if he wishes to become a jobber, the experience gained in a broker's office is invaluable, although it must be supplemented by training in a jobber's office.

Entry into a stockbroker's office does not necessarily involve the payment of a premium, but those who do pay one are usually in a better position than clerks who have paid no premium, and have much better opportunities of achieving their ambition of entering the House, as the Stock Exchange is called, either as dealers or brokers.

Let us suppose that a boy has been admitted as a premium-paying clerk to a member, with the understanding that he shall be advanced in accordance with the usual custom. He spends the first two or three years in learning the general routine work of the office, and the methods of dealing with Stock Exchange transactions generally. As he becomes more familiar with his work and its intricacies he becomes increasingly competent, and if he shows sufficient progress he may be promoted to a Settling Room Clerk, the minimum age for this position being 17 years. His work is then carried on in the House itself, a special badge worn in the lapel of his coat giving him the right of entry which is denied to the general public, and the nature of his duties is indicated by the title. This brings him into closer contact with Stock Exchange personalities, and he also learns how dealings are carried on and takes part in the settlement.

At the age of 21 years, with at least two years' service as a Settling Room clerk behind him, the future stockbroker may reach the coveted position of Authorised Clerk. There is great competition for this distinction, for each member may only introduce three clerks to the House and only one of these may be authorised, while the maximum number of Authorised Clerks allowed to a firm is two, with six Settling Room Clerks. The member introducing the Authorised Clerk must satisfy the Committee of the Stock Exchange that the candidate is eligible for admission and has satisfactory references, and permission is then given for him to take up his new duties.

Our Authorised Clerk is now actually in the House and qualified to transact business on behalf of the member by whom he is employed. He is thus within sight of his goal—membership of the Stock Exchange. His path is made easier than that of the applicant who has not served as an Authorised Clerk by reason of substantial concessions. When he has completed four years service in the Stock Exchange or the Settling Room, he may apply to be placed on the waiting list of candidates for election without nomination. He must be recommended by two members, who must act as sureties for him, and when he is elected his entrance fee is fixed at a lower sum than that of ordinary candidates. As a nomination need not be purchased, it will be realised that the total cost of becoming a member in this manner is considerably less than in the case of those admitted by nomination.

In the House itself choice must be made between the two branches of Stock Exchange work. The choice depends almost entirely on the individual inclination of the new member, and probably will have already been decided by the choice of the office in which the years of clerkship are passed. In many cases personal relations with members of firms already in existence settle the course to be taken.

Stock Exchange careers also may be pursued in the provinces, for similar institutions to that in London are established in Manchester, Liverpool, Glasgow and other large centres. These exchanges of course are smaller than the London Stock Exchange, and in many cases dealers specialise in certain classes of shares that are of particular interest to the people of the surrounding district and are usually termed Local securities. Thus cotton shares are prominent on the Exchanges at Manchester and Liverpool, cities that are closely connected with the cotton manufacturing industry, and motor car and motor cycle shares receive special attention on the Stock Exchange at Birmingham, a famous centre of the motor car industry.

Provincial Exchanges are conducted in a similar manner to the central institution and generally a career in one of them follows one of the two courses we have already described.

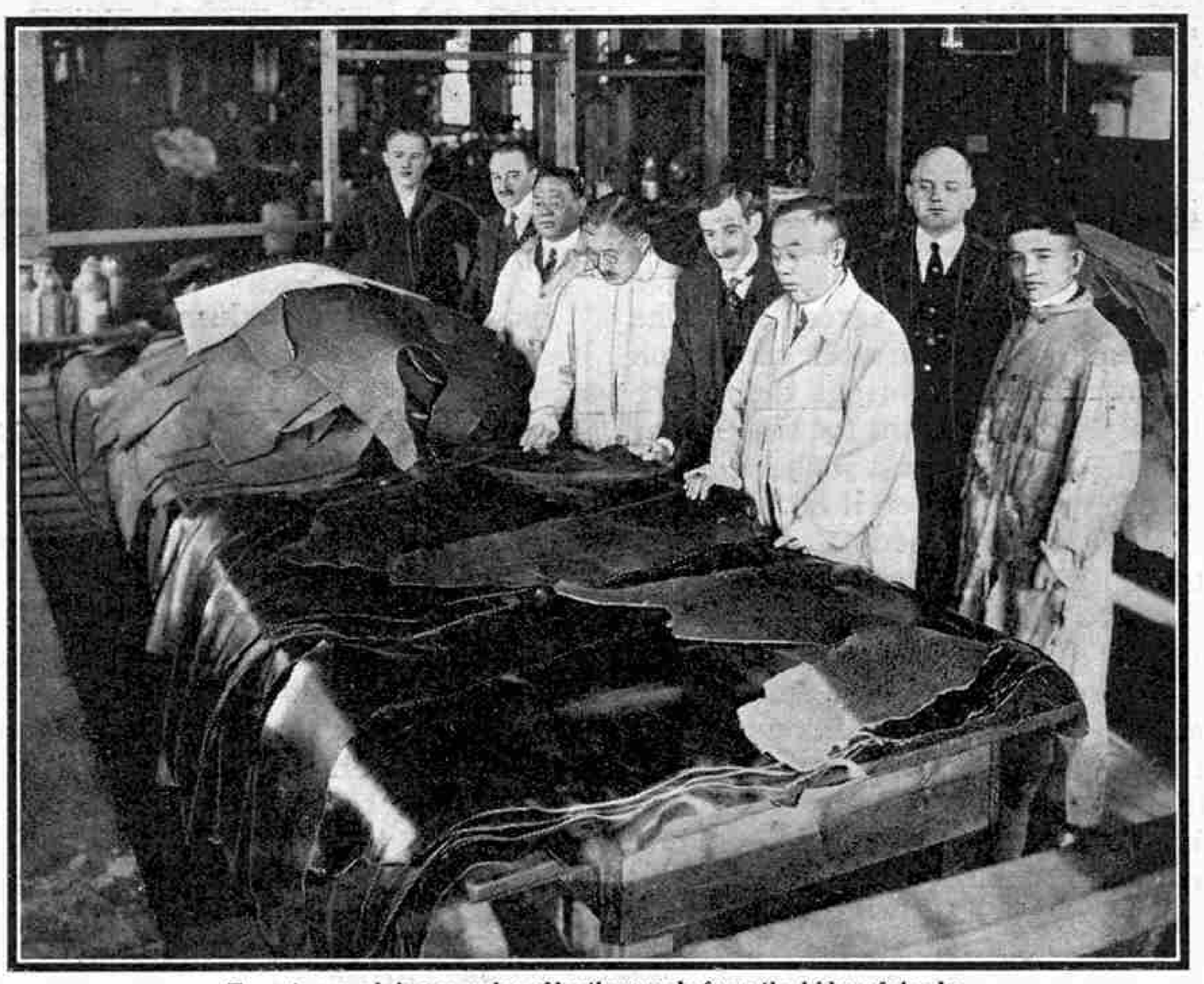
Leather from Shark Skins

Sea Monster Provides a New Industry

By H. J. Shepstone, F.R.G.S.

HITHERTO we have looked upon the shark as simply a scavenger of the ocean, a ferocious creature to be avoided, and certainly of little use to anyone. Now the scientist has discovered that the shark is more valuable to Man than the pig.

From the hide of a shark various grades of durable leather can be made, and medicinal and other oils obtained from its liver and intestines. Its head is converted into glue, its teeth are sold to jewellers and its fins to the Chinese, its bones are ground down into a fertiliser, and its flesh is used as food, shark meat being not only edible, but very palatable. Not a particle of the fish need be wasted, and to-day a shark, which costs nothing to rear or feed, and may be had in virtually unlimited quantities for the taking, is in reality as valuable as many a prize animal on a farm.

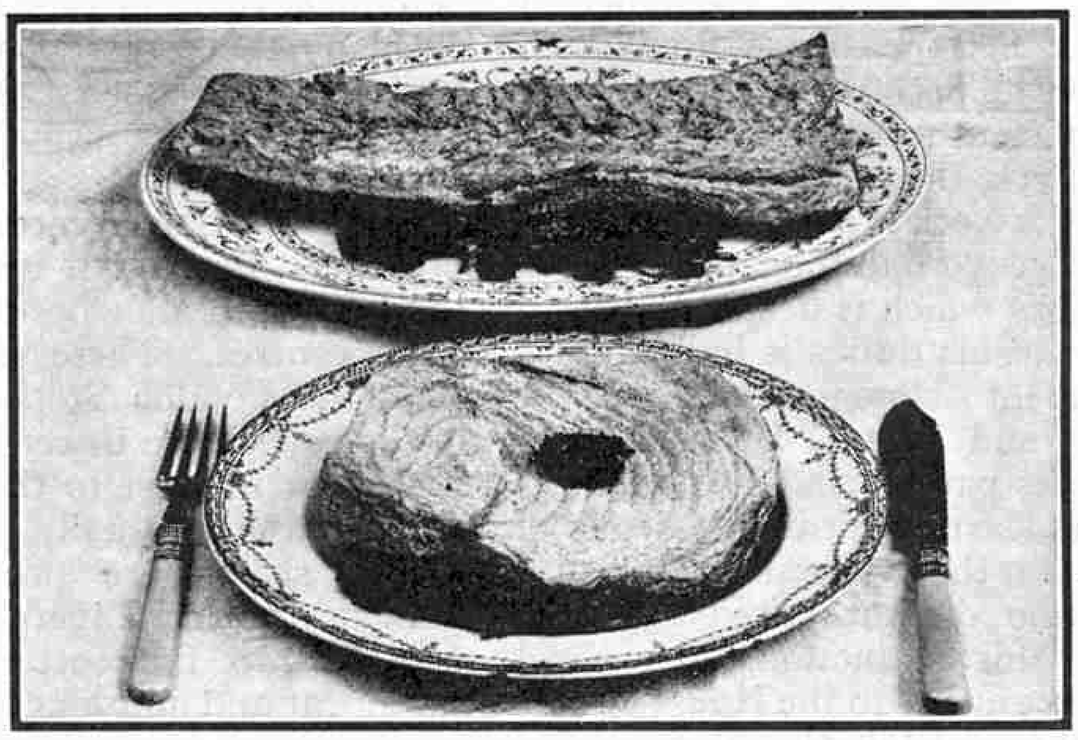


Experts examining samples of leather made from the hides of sharks.

No man has done more to awaken interest in the commercial possibilities of the shark than the noted scientist Dr. Alfred Ehrenreich. As the result of many years of research and experimental work he discovered how the hides of the great fish could be successfully treated and converted into leather. The manner in which he came to conceive the idea of utilising the skins of these monsters of the ocean for leather-making forms an interesting story.

Some years ago Dr. Ehrenreich recognised, as did many other experts, that the demand for leather was increasing at such a rate that in a short time there would not be sufficient animals being slaughtered to meet the demand. We find it necessary to import between £12,000,000 and £15,000,000 worth of dressed leather a year, in addition to a large quantity of hides and skins. Leather is continually being put to new uses, and in future it is going to play an important part in upholstering furniture and as a dress material.

Dr. Ehrenreich was interested in deep-sea life, and naturally he thought of the shark, the porpoise, and the whale as creatures whose hides might possibly be converted into leather. He went shark-fishing and met with some exciting experiences, but the leading tanneries to which he sent the skins all declared emphatically that it was impossible to make use of them for leather. Dr. Ehrenreich then built a laboratory of his own, learned something of the art of tanning, and started to experiment. He was successful, but it was only after many years' hard work, and the spending of a fortune, that the difficulties were finally overcome.



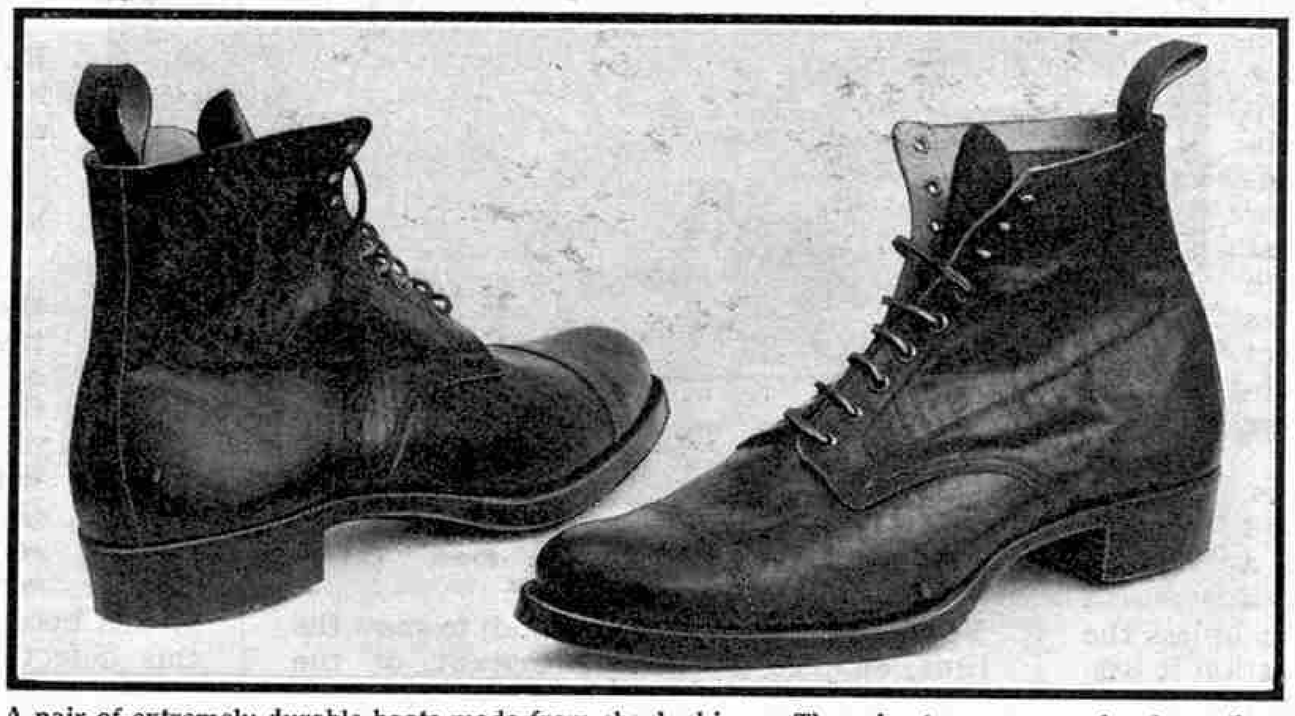
Shark meat is quite palatable, and shark steak is sold in some of the restaurants in the Far East.

The hides were found to be too spongy for use as ordinary leather, which meant that they lacked sufficient strength for commercial use. There was also the presence of a distinct fishy odour, and the necessity of removing the horny exterior, or shagreen, without spoiling the underlying skin. Without going into technicalities, it may be briefly stated that the first difficulty was surmounted by soaking the hides of the fish in a certain lime solution; while a de-greasing treatment got rid of the fishy odour. The removal of the horny exterior proved the greatest obstacle. It was a chemist who solved the problem, and he discovered the method by accident. A skin was thrown into a bath of chemicals, and when it was fished out next morning it was found that the solution had

worked the miracle, for it enabled the shagreen to be completely separated from the underlying skin, while leaving the hide with its characteristic grain.

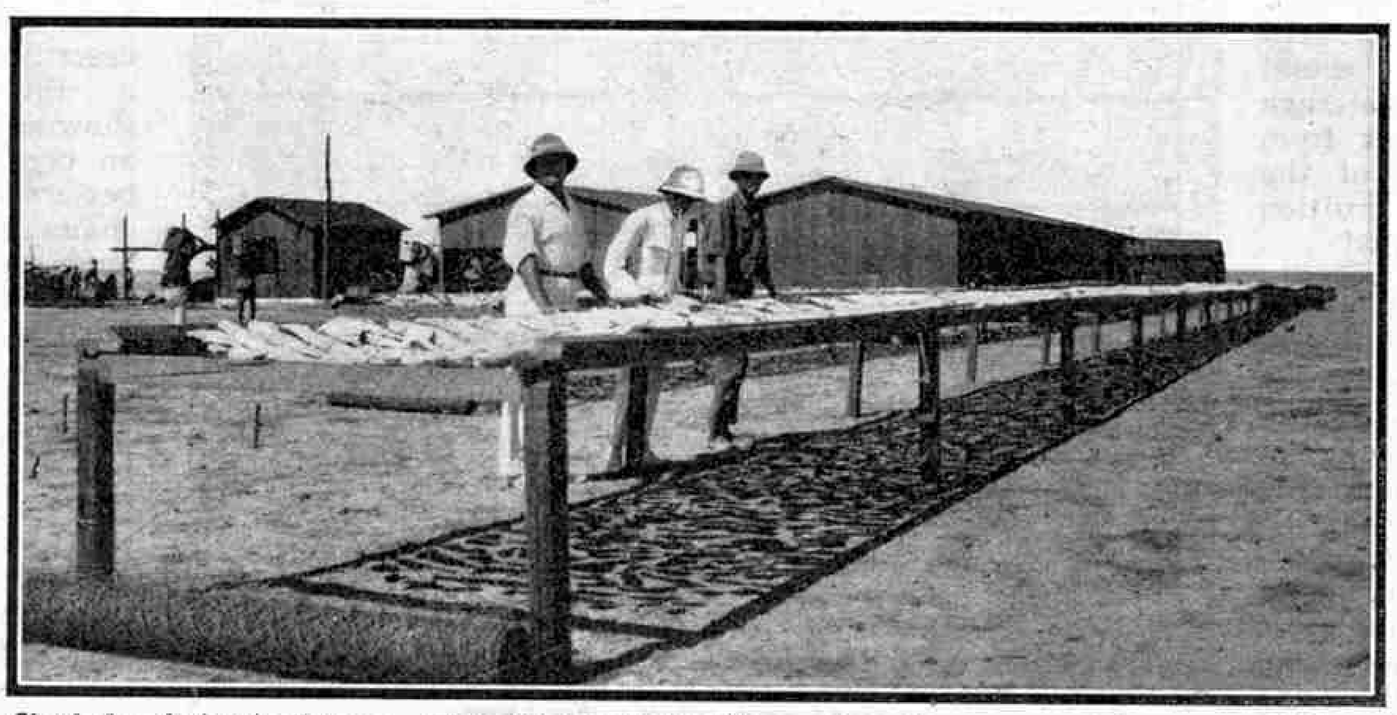
The experimental stage is now over. To-day thousands of sharks are being taken in the Gulf of Florida, in the Red Sea, and off the coast of South Africa, and their hides converted into leather and the remainder of their carcases into valuable by-products. So far has the art of the leather manufacturer advanced that he can take the hide of the shark and convert it into leather of many grades, from the thinness of a wafer to the thickness of stout cardboard. It may be plain or smooth, or possess lovely scale markings and distinctive grains. By a secret process of dyeing, varied and beautiful colours may be obtained, gold, blue, pink, green, etc. Furthermore the leather can be rendered waterproof, and articles of clothing made of this material will last almost a lifetime. Shark leather does not "pipe" or "scuff" off like calf leather, and tests have shown ordinary samples to have a tensile strength of 5,000 lb. to the sq. in., against 4,000 lb. of the best calf leather. Experiments have shown some samples to be almost as tough and strong as tempered steel.

A fishing station on the Red Sea. Here sharks are taken for their hides, which are converted into leather.



A pair of extremely durable boots made from shark skins. These boots were worn by the author for over two years.

The shark is a ravenous feeder, consuming its own weight in food every day. As it virtually swallows whole the fish on which it feeds, its digestion is very imperfect. This causes an enlargement of the liver, and in the larger species this organ assumes quite abnormal proportions. An oil is now being obtained from the liver, containing a large percentage of iodine of a distinctly curative potency. Isoline, a cure for diabetes, is obtained from the pancreatic acid that the creature uses to start rapid digestion. In addition to these more valuable oils, others are obtained for use as lubricants, for the making of margarine and soap, and for tempering steel. From the head and small fins of the fish a very serviceable glue can be made. The larger fins, after being sun-dried, are sold to China, where they are looked upon as a great delicacy; and the flesh of the creature forms a valuable food.



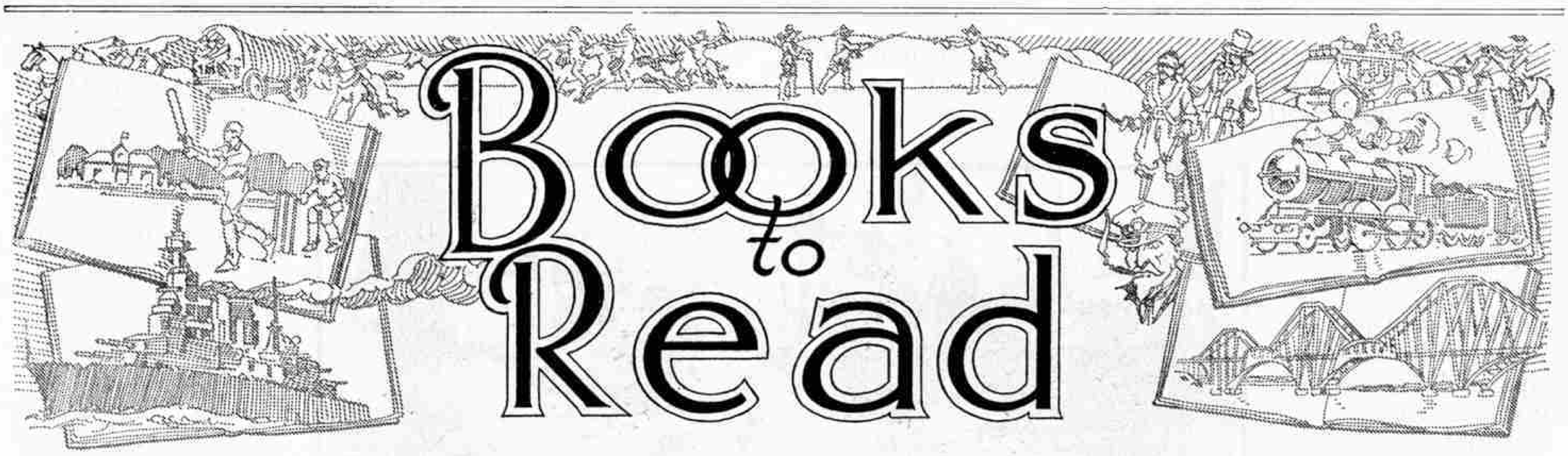
Shark fins drying in the sun. They are exported to China, where they are regarded as a great delicacy.

"The shark," says Dr. Ehrenreich, "is the most valuable fish in the ocean to-day, and from an average specimen we can obtain 10 sq. ft. of leather from the hide alone, while the stomach furnishes a raw material that yields a leather which is soft and strong. All the members of the shark family can be utilised in this way, and to-day we are using the hides of the manta, ray, skate, and saw-fish, as well as the big sea mammals, such as the porpoise and the whale. From the hide of a single whale many scores of boots, yards of belting, and half-a-dozen large trunks could be made.

"What is equally important is that there is no fear of the supply becoming exhausted. Sharks exist in millions, and are to be found in all the seas. Off the coast of North Carolina there is a long stretch of coral rocks, enclosing a deep sheet of water about equal in area to that of the English Channel. Only narrow openings give access to it, yet from observations made by noted scientists it is computed that between 1,000,000 and 1,250,000 sharks pass every day in and out of these coastal waters.

"Most people look upon the shark as a natural enemy of mankind, a sinister monster of the deep, seeking whom he may devour. My experience of this creature—and it is based upon years of actual study of them in their natural haunts—is that it is a big bully and a coward. He never attempts to fight unless he is on top. He will follow a small boat

(Continued on page 388)



Here we review books of interest and of use to readers of the "M.M." We can supply copies of these books to readers who cannot obtain them through the usual channels. Order from Book Dept., Meccano Limited, Old Swan, Liverpool 13, adding 1/- for postage to the price. Postages on different books vary, but any balance remaining will be refunded.

"The World of Sound"

By Sir Wm. H. Bragg, O.M., F.R.S. (Bell. 4/6)

Although sound belongs to a branch of science the wonders of which are as yet imperfectly appreciated by most of us, anyone who reads Professor Bragg's volume will find it a subject of singular fascination. The book, which is based on six lectures delivered at the Royal Institution, also opens up a field of experiment and observation that will be of considerable interest to all our readers. Of particular interest is the chapter that deals with sound in war, for it tells us how sound was used to detect the presence of enemy submarines and to calculate the position of enemy guns.

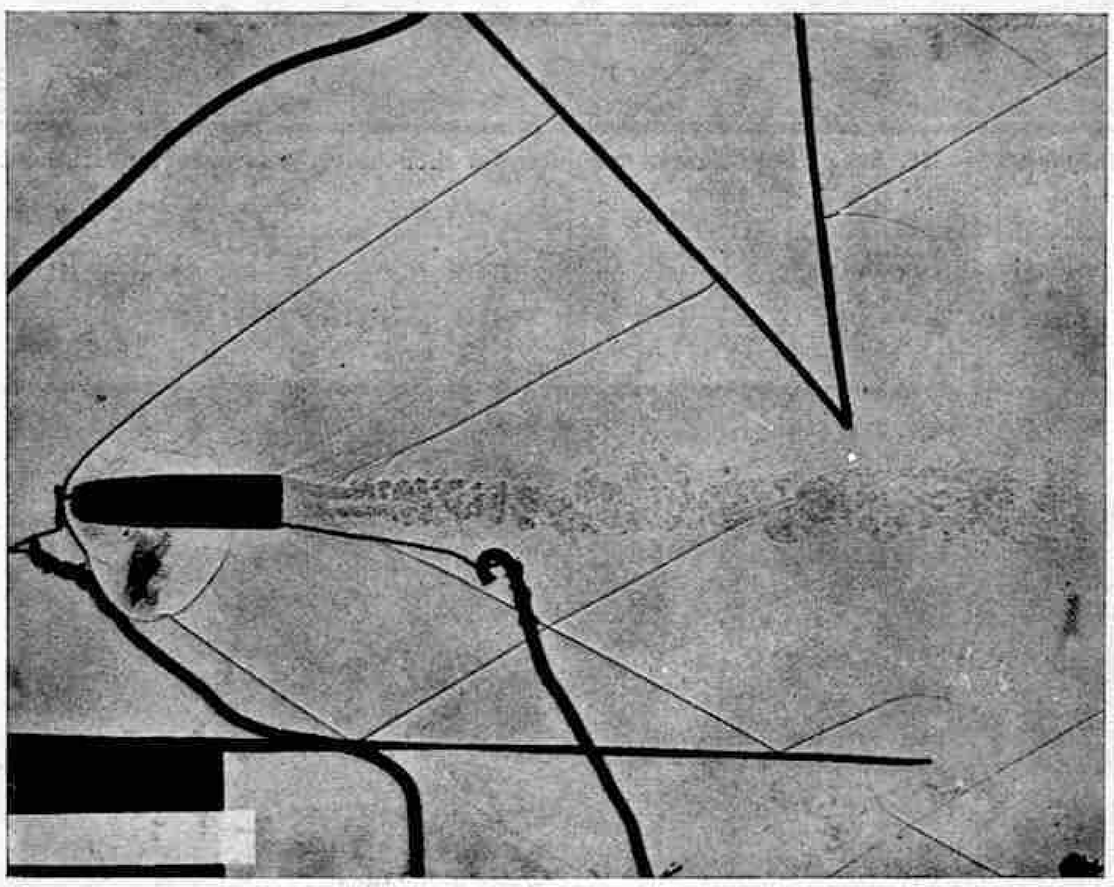
In certain circumstances, sound in the water can be heard at a distance of more than a mile, but the detection of a submarine is not of much value unless the observer can find in what direction it lies. Sir William lucidly describes the method, based on a principle used by the late Lord Rayleigh, that is now embodied in an instrument called the directional hydrophone.

The French were the first to experiment in the use of sound to locate enemy guns. As Sir William explains, the shell from a modern high velocity gun makes a sound as it passes overhead like the crack of an explosion, and either from this, or from the sound of the firing of the gun itself, the position of the gun can be calculated.

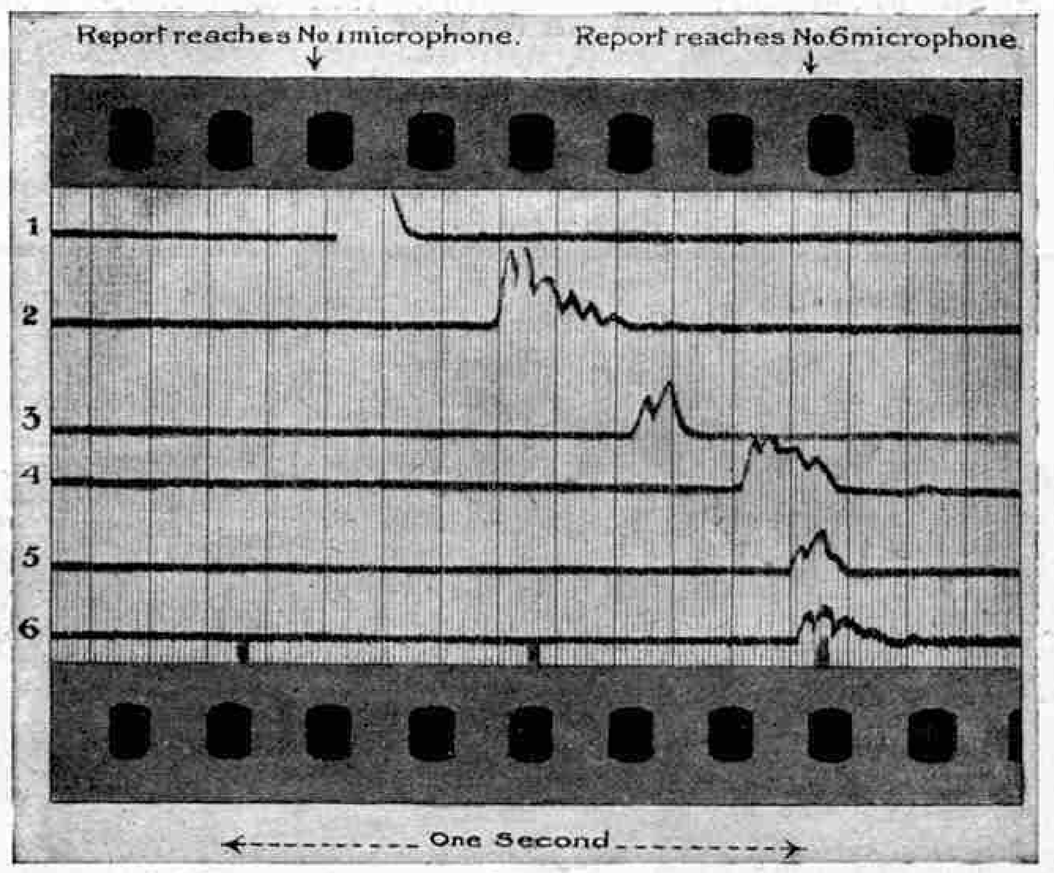
When a bullet or high velocity shell is moving faster than the velocity of sound, V-shaped waves spread out on either side in the air, and such waves have been photographed in the case of a rifle bullet. In the War, a simple but highly efficient method was adopted by the British Army for detecting enemy guns by sound ranging, as it is called. In order to give great accuracy, six microphones were used, the wires from them being led to a central station where each was joined to its own recorder on a cinema film. So long as there was no sound recorded by any microphone, six straight lines were drawn side by side on the film. When an explosive wave from the gun reached a microphone, however, the corresponding line on the film was broken successively as the wave reached the microphones in turn. Vertical lines (100 to the second) to show the time, enabled the exact instant of the arrival of the sound to be determined, enabling observation to be made to three thousandths of a second.

The central station was placed in a cellar or dug-out some 5,000 yards from the front line. When observers saw hostile guns fired and considered that the records were desirable, they pressed a key by which the apparatus at the central station was set in motion. The film was then developed, measured, and read, and within a few minutes a telephone message would be on its way to our own batteries giving them the position of the enemy gun. It is interesting to learn that by this method the average error at a range of 10,000 yards was only about 50 yards.

The book, which is one of Bell's Popular Science Series, is well illustrated, but lacks an index.



A bullet from a Martini-Henry rifle, photographed in flight, showing two V-shaped ripples, one from the nose and one from the rear. From "The World of Sound" reviewed on this page.



Part of a Ciné film showing the record of the firing of a 15 cm. German howitzer. The horizontal lines—the records made by the microphones—are unbroken until the sound wave arrives. (See above.)

"The Home Cinema"

By J. P. Lawrie. (Chapman & Hall. 3/6)

The increasing popularity of the home cinema is indicated by the growing number of books on the subject. In his preface the author remarks that in many of the publications dealing with sub-standard cine work, the question of projecting, or screening, the picture is dismissed with casual reference, and that in this book he has endeavoured to rectify this defect. He has succeeded in doing so in a series of interesting chapters that cover every aspect of the projection side of this fascinating hobby.

The opening chapter gives clear and practical advice on the purchase of a cine-camera, and of a projector, rewinder and screen. This is followed by an interesting description of how the film used in the camera is made. The showing of home films should be an occasion worthy of something better than a mere grouping of chairs in front of a small screen hung on the wall, and the author gives many useful hints on how to impart to the room something of the air of a real cinema. He suggests simple but effective decorations, an orchestra provided by gramophone records, and the arranging of the film programme on the lines of the professional picture theatre.

The later chapters deal with the production of amateur films, and the writing up of the script and scenario. They touch on the choosing of attractive titles; the making of novelty and other out-of-the-ordinary films, and contain practical advice on how to use a cine-camera to profitable account.

"Sea-Dogs of To-day"

By A. J. VILLIERS. (Harrap. 7/6 net)

One's first impression of "*Sea-Dogs of To-day*" is that of contact with the real thing. In his preface the author says: "Anyone may write a sea book. All that is necessary is to buy copies of the other sea books already written, and then to compile from these a book that is more or less your own. You need never have gone to sea; you need not even have wanted to do. . . . . There is no need to compile sea material of that kind; there is new stuff for the making of a hundred good stories if only some one will see to it and go after it." Certainly this is not a mere compilation. The author has himself known the men of whom he tells, has gone to sea on long voyages with them, and has seen their feats of daring.

Mr. Villiers was born at Melbourne, Australia, in 1903. At an early age he went to sea as a cadet in a "square-rigger," but the master died, the new master was mad, and so he cleared out. Then followed a year or two before the mast of sailing vessels. In a Finnish four-masted barque a 74-day passage from France to Australia ended with the ship cast ashore; and a heavy fall caused by the vibration of the masts when the ship hit the beach finished Villiers' sailing ship experiences for a time. He "left the sea and went into steam." Steam was dull, however, even when a wool-laden freighter bound from Australia to England caught fire outside Colombo, and got back to port just in time with her steel decks red hot and one of her holds a blazing inferno. Subsequently he went whaling under the Norwegian flag with a 12,000-ton whaler into the Arctic, and shipped in the big four-master "*Herzogin Cecilie*" and in the full-rigged ship "*Grace Harwar.*" As the result of this variety of experience Mr. Villiers writes with authority as well as enthusiasm.

Among the "Sea-dogs" dealt with in his present book is Carl Larsen, the founder and guiding spirit of modern whaling, whose career is a wonderful story of passionate love for the sea and determination to succeed in the task he had set himself of reconstructing the Norwegian whaling industry. Later we meet Captain Fearon, a veteran of 36 roundings of the Horn, who tells us of his first voyage as an apprentice in 1871:—

"During the homeward passage I had my first experience of tragedy and the needless waste of human life. All through the fine weather of the trade-winds the heavy double sheets had been taken off the mainsail, and only the single clew rope used as a sheet. That was all right as long as the weather was fine, but before approaching stormy latitudes the double sheets ought to have been shackled on. I can only put it down to want of forethought, or carelessness, but this was not done until the ship was approaching the Azores, when during a stormy night it was evident the single clew rope on the mainsail was not strong enough to hold the sail. The order was given to shackle on the double sheet, and while doing so the clew rope parted, and the man who was shackling on the sheet suddenly lost his support, fell overboard, and was drowned.

"There was no chance of saving him on a dark night, with the ship racing through the water and an increasing gale blowing. His life was needlessly thrown away. I got a shock the next day when the man's clothes were callously sold by auction. Life was evidently cheap in those days."

A particularly interesting chapter deals with "Good Ships—And Bad." Have ships personalities? No old seaman has any doubt on the matter, and there are plenty of hard facts to support his view. Two ships built at the same yard, by the same men, from the same materials and the same plans, which should be equal in every respect, will turn out utterly different. One ship will invariably be lucky, the other unlucky; one will be a man-killer, the other will never lose a man. The author gives many interesting contrasts of this kind, among them that of the pair of Stewart barques "*Chili*" and "*Peru.*":—

"If ever two trim little barques were exactly similar in every outward thing, they were the '*Chili*' and '*Peru.*' If ever two sister ships gave completely different performances, and were utterly dissimilar in their sea careers, they were the '*Chili*' and '*Peru.*'

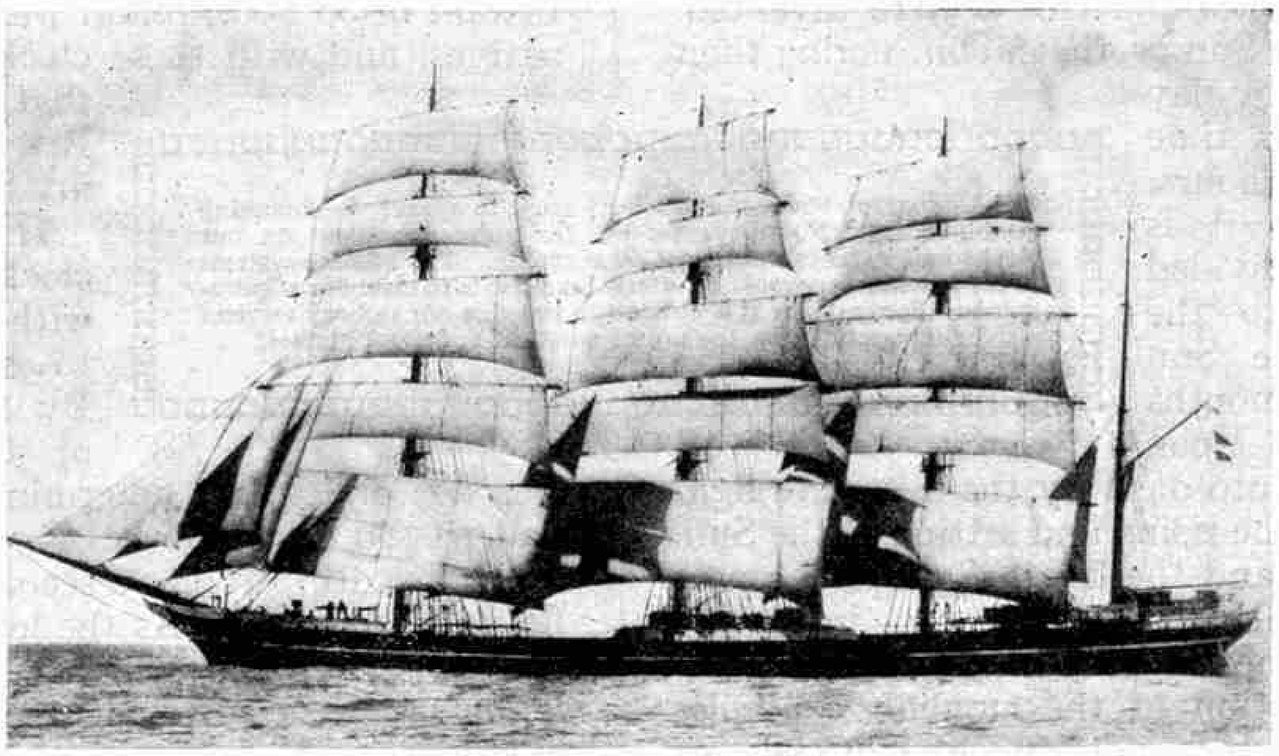
"Trim little barques both, they were rigged, lined, manned, and stored the same way: they were the same in everything but name. If you saw one you had seen both. . . Yet the '*Peru*' was a lovely little ship which always made good passages and never was in serious trouble, and the '*Chili*' was a fair devil that was always creeping toward the 'overdue' list, and giving underwriters, charterers, pilots, sailors, and owners trouble. Why? Nobody has the least idea. The '*Peru*' consistently sailed five voyages to the '*Chili's*' four. The '*Chili*' bumped into dock walls, got into arguments in court, dragged her anchors, suffered deck damage in heavy weather, was deserted by her crew, got short of food, missed charters, fouled buoys, damaged her cargoes, and made long passages. The '*Peru*' never hurt herself nor anyone else while she was under the Stewart flag; she made good voyages and she paid."

Two typical Norwegian Whalemen. From the book "Sea-Dogs of To-day" reviewed on this page.

The days of the big sailing ships are rapidly reaching their close, and there is a deep sadness underlying the author's chapters on Captain Gustaf Erikson and his ships that have their home at Mariehamn, the tiny Finnish port in the Aland Islands. How long will these splendid vessels be afloat; will they survive their owner? Erikson began his sea career at the age of nine as a cabin boy; at the age of 60 he owns some 20 deep-sea square-rigged sailing ships. Through the worst depression that shipping has ever known he has kept his great ships afloat and he still makes them pay.

"I love those ships," he says. "I have spent my life in them and for them, and I will keep on. When I go they go; but while I stay they stay. . . . How can I keep them on? Because I never have a holiday; because I look after them all personally; because I don't let others do anything I can do myself; because I keep always a good lot of young chaps in them who are trained in them to become officers; and because not one of them is insured. I cannot afford to have them insured. . . . I have been a mate and master, too, as well as cabin-boy and cook. I have the ships brought home to Mariehamn whenever they have to lay up in Europe, and I climb the rigging and go out along the yards myself and do my own surveying. I see that . . . the masts and yards will carry their sail round the Horn and anywhere else I send them."

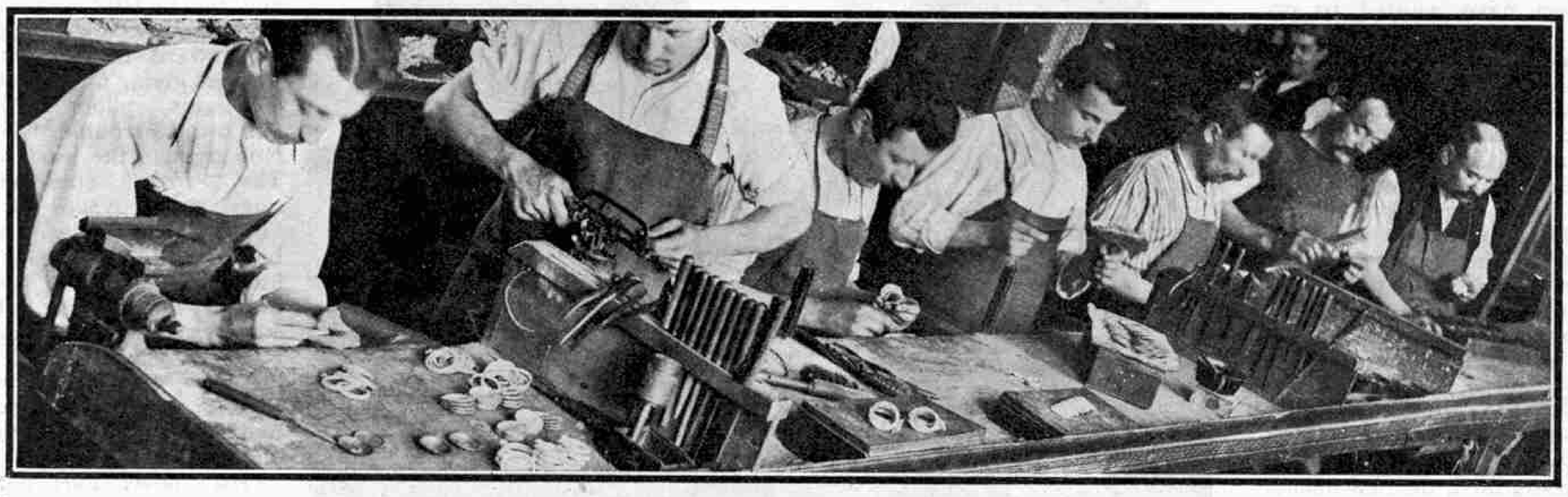
With the author, one hopes that these white-winged ships will go on, "and that a little old man in Mariehamn, who likes pea-soup and never takes a holiday, may dream of his great ships ramping home in the trades and running their easting down, and smile."



"Garthpool," Britain's last deep-water sailing ship, wrecked in 1929. (See above.)

What Time Is It?

The Romance of Clock-Making throughout the Ages



ON a fine summer night we look up at the sky and admire the pale light of a star, and at the same time perhaps there shines before us a light from a neighbouring house. Are these two lights simultaneous ? Yes, our eyes tell us. No, say the astronomers, the light of this star has taken perhaps a thousand years to reach the earth, and if the star were to burn out it would continue to shine to your eyes for a thousand years ! Time, therefore, is an illusion of our senses, but it is an illusion that we are obliged to take count of in our everyday life, and to try to measure it.

It is hard to realise how the people of old were able to tell the time before watches and clocks were invented. They did so either by the Sun or the Moon, noting their positions in the heavens by day or night. In those days time was not measured by hours, minutes or seconds, as it is to-day. Instead it was divided into years, according to the apparent motion of the Sun among the stars ; into months by the revolution of the Moon around the earth ; and into days by the alternate light and darkness caused by the rising and setting of the Sun.

The photograph above shows a busy scene in a large watchmaking establishment. Nowadays we are far more dependent on our clocks and watches than most of us realise. The ancient systems of time measuring would be utterly inadequate to meet our requirements. For instance it is difficult to imagine our railway services being operated by the aid of sundials and sand glasses.

As civilisation spread and the lives of people became more ordered and regular, there was an increasing demand for some other means of measuring time. This resulted in the introduction of the sundial, examples of which are still to be seen outside old churches, or in old world gardens. A sundial tells the time by recording the movement of the shadow of the Sun as the Sun moves across the sky. It consists of a horizontal dial from the centre of which projects a rod, the shadow of which, following the Sun's movement travels round the dial, and points to the hours that are engraved round the edge of the dial. Sundials have the great disadvantage that they show only the bright hours ; if a cloud veils the Sun, the hours disappear.

About the year 330 A.D. sand-glasses were introduced. These were glass vessels shaped something like a figure " 8." They consisted of two conical glass containers connected by a narrow passage. One of the containers was filled with sand, which fell by gravity slowly from the upper to the lower container ; as soon as the top container was empty the glass was turned upside down, and the sand ran back again into the first container. The modern egg-boiler is a typical example of the old sand-glasses.

Another very early time-measuring device was the water clock. From old models discovered and from references in ancient documents we know that water clocks were used by the Greeks, and also by the Indian tribes of America. Julius Cæsar, when he invaded Britain in 55 B.C., found water clocks in use among the natives, and with these clocks is said to have observed that the summer nights in Britain were shorter than those in Italy.

In its original form the water clock consisted of a vessel filled with water, which was allowed to escape through a small hole. By noting how far the level of the water had fallen, it was not difficult to determine the interval of time that had passed since the vessel was filled. In a later form the water dripped into a second vessel in which a wooden figure was placed. As the level of the water rose in the second vessel the wooden figure floated higher and higher, and the intervals of time were thus more easily noted.

Some of these water clocks were very elaborate and complicated, and not only measured the time, but also carried out interesting performances at each hour. A wonderful example of a water clock was made in Gaza about the sixth century A.D. In this there were 12 eagles made of bronze, each holding a crown. At each hour an allegorical figure representing the Sun gave a signal, and Hercules emerged from the interior of the clock and was crowned by one of the eagles, each of which represented one of his 12 great deeds.

Another curious water clock was that which was presented by the famous Caliph Abraschid to the Emperor Charlemagne. The dial of this machine

incorporated 12 small doors, which opened at the hours that they represented and allowed little balls, the number of which equalled the particular hour, to fall out and strike the time upon a brass bell. Then 12 little knights mounted on horseback issued forth, one from each door, and having paraded round the dial re-entered the holes in the dial and shut themselves in again.

None of these early devices solved the problem of measuring time accurately, as this was not accomplished until the invention of the weight-driven wheel clock. Many vague allusions to wheel clocks occur at a very early period, but whether they were actually wheel-and-weight clocks seems doubtful. To a certain extent wheel clocks were a development of water clocks, in the later models of which a water-wheel took the place of the empty vessel and the floating piece of wood. The water dropped on to the paddles of the wheel, driving it round, and every time the wheel made a complete circle a gong was struck. Later a falling weight took the place of the dripping water, so it was in this way that the weight-driven clock first came into existence.

Wheel clocks were greatly improved by a German named Henry de Wyck. In his clocks a rope with a weight attached was wound round a cylinder or barrel that resembled the roller of a household "mangle." As the weight dropped, the barrel revolved, moving the clock hand through a train of gear wheels. In his early models de Wyck found that as the weight dropped the speed at which the wheels revolved became faster and faster. Eventually he overcame the difficulty by fitting a series of spikes to a small wheel, and by means of a mechanism that resembled a pawl and ratchet, he checked the revolutions of the barrel.

Clock repairing turns out to be more difficult than he expected.

The next important step in the perfecting of clocks was the discovery of the pendulum by the famous Italian Galileo. One day in the cathedral at Pisa he noticed the regular movements of a hanging lamp that had been set swinging while being lighted. He was struck by the fact that the motion of the lamp never seemed to vary, and by feeling his pulse he counted the time required for one swing of the lamp. To his amazement he found that the lamp always required the same amount of time to complete one swing, although the swings were becoming gradually of less and less extent. Convinced of the value of his discovery, Galileo soon completed a model of the lamp by fixing a weight to the end of a long bar of metal, and it was not long before he had adopted this pendulum to work an astronomical clock. Subsequently pendulum clocks of the "grandfather" type became common, and at last the world had a fairly accurate means of keeping time. After "grandfather" clocks had been in use for some time clockmakers turned their attention to the construction of portable clocks, and it is from them that our present-day watches originated.

In 1525 Jacob Zech of Prague built a clock in which he used a coiled spring placed in a drum, which revolved as the spring uncoiled. To the drum was attached one end of a string of cat-gut, which was wound on to a conical roller called the "fusee." When the spring was fully wound the chain lay at the small end of the fusee, where it had very little leverage on the clock mechanism. As the mainspring unwound, and its force became less, the chain came off a larger radius of the fusee, and thus a greater leverage was obtained by the spring. This is the oldest portable clock in existence. In the early portable clocks, or watches as they afterwards became, a small flywheel, actuated by a hair-spring, was used in place of a pendulum. Its regular movement allowed the main spring to unwind a little at equal intervals in exactly the same manner as the pendulum allows the weight to fall a little at each swing in the heavier types of clock.

Many of the clocks built in those days were very complicated and elaborate, and they not only served as time-measuring instruments, but also they were so constructed that, when the hours struck, miniature figures of birds, animals or men were set in motion and carried out curious performances. Some idea of the wonderful work done by these early clockmakers will be afforded by the following account of a remarkable clock built at Pittenween in Scotland. The case was 7 ft. high and contained a large eight-day musical clock, three dial plates and a chime of 16 bells.

The mechanism was divided in five different parts, each of which was driven by a separate weight. The first was the time-keeping part; the second drove a small musical barrel that played a chime at the first, second, and third quarters, and a favourite tune at each hour. The third part struck the hour, and the fourth drove a large musical barrel, which contained eight Scottish tunes, one of which it played every three hours. The fifth part of the mechanism changed the tune. The front dial plate, which was about 15 in. in diameter, had an arch that showed the hours, minutes, and seconds, with the name and day of the month throughout the year. One of the dials represented in miniature the front of a house, with a door in the middle, and the front stair. At each side of the door stood a sentinel. In the doorway was a figure representing the mace bearer to the lords of the Scottish Council. As soon as the clock began to play the mace bearer took off his hat and turning about walked into the interior of the clock, followed by a procession of 15 councillors!

FROM OUR READERS

These pages are reserved for articles from our readers. Contributions not exceeding 500 words in length are invited on any subject of general interest. These should be written neatly on one side of the paper only, and they may be accompanied by photographs or sketches for use as illustrations. Articles that are published will be paid for at our usual rates. Statements contained in articles submitted for these pages are accepted as being sent in good faith, but the Editor takes no responsibility for their accuracy.

Pavement Made of Whalebone

The town of Monterey is on a bay of the same name on the coast of California, and is about 125 miles south of San Francisco. It was founded in 1770 as a mission station and garrison by the Spaniards, who then controlled California, and it still retains many interesting reminders of the days when it was the chief centre of a Spanish province.

The visitor to this quiet little town will notice in front of the main door of the old Spanish church of San Carlos Borromeo a considerable space paved with curious discs. One would be likely to make many guesses as to what this curious paving material might be before one hit upon the correct answer, for the discs are whales' vertebrae.

This unique pavement owes its origin to the whalers of Monterey, for half a century ago the town was the headquarters of a flourishing whaling industry. Who laid the pavement down, and why whalebone was used for this queer purpose, is not known; in Californian history 50 years takes one back almost into antiquity. It may be guessed, perhaps, that it represents the fulfilment of some devout whaler's vow that if San Carlos would prosper his voyage he would commemorate the saint's goodness in this remarkable manner.

H. J. SHEPSTONE (London).

A unique pavement of whalebone before the old Spanish church of San Carlos Borromeo in Monterey, California.

A Famous Flint Knapper at Work

When spending a holiday near Brandon, Suffolk, I remembered the interesting article in the "*M.M.*" for August, 1927, on the flint industry, and decided to visit Mr. Snares, its chief representative. Mr. Snares was very pleased when I told him why I had called and was delighted to have an opportunity of demonstrating his methods. He led me into his workshop and there, with layers of leather bound on his left thigh, he tapped away at the flints in what almost seemed a casual manner. While watching him flint knapping appeared simple, but a trial showed me that years of experience are necessary.

Mr. Snares then showed me some of his products, including flints for tinder boxes and guns, and reproductions of arrow heads, spear heads and other weapons of the Stone Age.

H. LEGERTON (Norwich).

Down a Derbyshire Lead Mine

Some time ago I visited the Speedwell Mine, situated at the foot of Winna Pass, near Castleton in North Derbyshire. On entering the mine I joined a party about to make a tour of its wonders, and we followed our guide down a flight of about 170 steps. As we descended we began to shiver, for we felt the change from the summer heat we had left above to the low temperature in the depths of the earth.

Presently we reached a stream flowing through a tunnel that had been cut by miners in search of veins of lead ore. Along this tunnel we travelled in a boat that seemed to fill it. Oars could not be used for lack of room, and the guide propelled the boat by pushing against the rocky walls. The scene was an eerie one, for the only light came from candles stuck on the walls at intervals of a few yards, and I noticed that there was only one place in the tunnel where boats proceeding in opposite directions could pass each other.

After we had made our way in this laborious manner a few hundred yards along the tunnel we heard the noise of falling water, and soon found ourselves in a chamber containing a huge cavity into which the stream falls. This cavity is known as the Bottomless Pit. It was given this awe-inspiring name by the miners who opened out the tunnel, for the 40,000 tons of debris they threw into it seemed to disappear into its cavernous depths. A sluice has been built to retain the water in the tunnel, and our guide now opened this, causing the water to gush forward and precipitate itself into the pit with what seemed to me to be a terrifying noise. While listening I wondered at the hardihood of those who had first ventured so far underground.

We remained in the large cave for some time, gazing at the water as it rushed over the sluice into the Bottomless Pit in the weird light of the candles, and looking at the roofs and walls of the cavern. Finally we re-entered the boat and returned to the foot of the steps, by which we made our way into what by contrast with the cold world below seemed to be almost unbearably tropical conditions at the surface.

E. A. WHITAKER (Sheffield).

Mountain Climbing in New Zealand

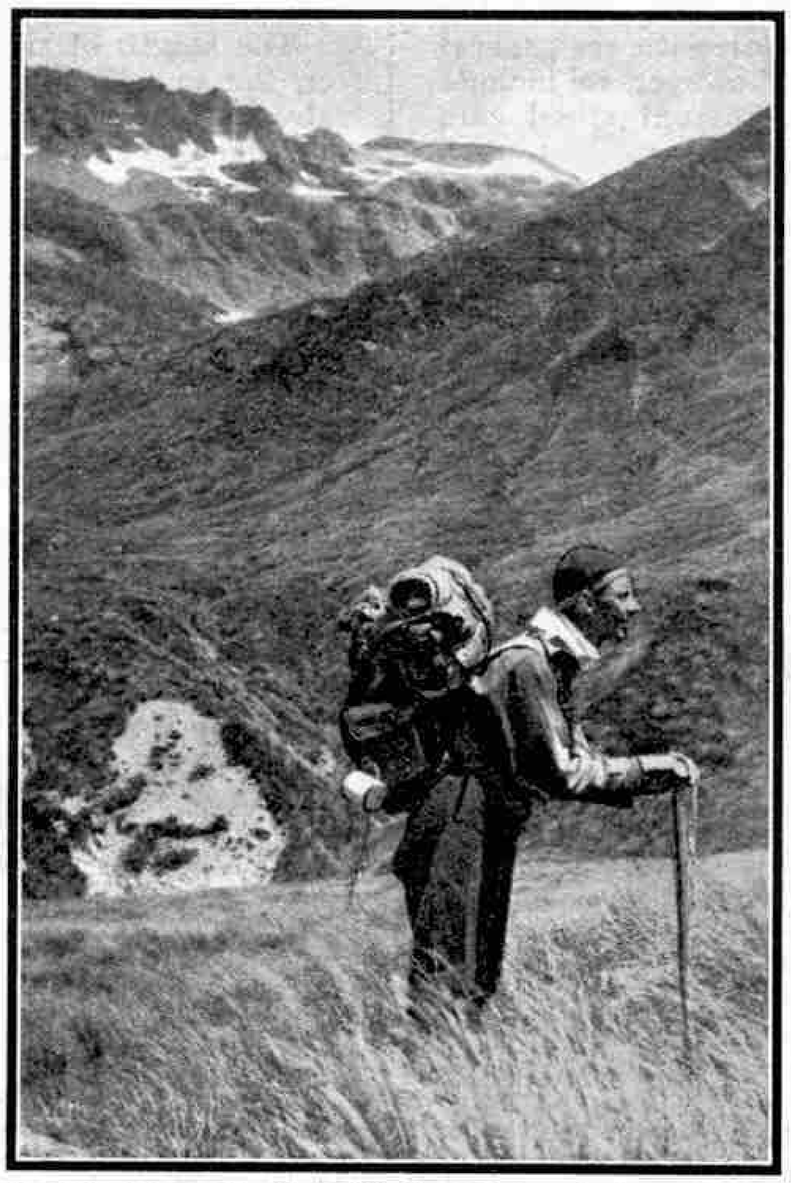
With two members of the Canterbury Mountaineering Club, I left Christchurch on the *"Midland Express"* to spend a few days among the Southern Alps. After a slow and tortuous climb through the Waimakiriri River Gorge, the train stopped at Mt. White Bridge to allow us to get off to begin our trek. This bridge is not a regular stop, but the New Zealand Railways are always willing to disembark climbers at any point on the line, in spite of the difficulty of restarting on the heavy gradients.

Camping in the Taruahuna Pass, in the Southern Alps, New Zealand. For the photographs on this page we are indebted to R. Burbery, Lyttelton, who in this illustration is seated before the tent.

After adjusting and tightening our packs, we crossed the bridge and set off to the mouth of the valley through which the Hawdon River flows, and up which our route lay. It was oppressively hot, and we were thankful to reach the shade of the bush. There insect life soon made itself apparent. Huge dragon-flies with a wing spread of about four inches hovered round us, their buzzing noise reminding me irresistibly of fast aeroplanes. Later I learned that these insects had been introduced into the country to combat the sand-fly, which has a sharp sting and is annoyingly persistent.

As we made our way up the bed of the river the valley became narrower, and a few miles onward we scrambled over enormous boulders with a wall of trees on each side. This was the most delightful part of our day's walk, for a cool breeze blew in our faces, and we decided to make camp there for the night. We built a blazing fire and lay near it on our sleeping bags; and as darkness fell there stole over the valley a peculiar quietness broken only by the occasional call of a mountain duck high on the hillside behind us.

Next morning we breakfasted hurriedly, in company with a swarm of sandflies and mosquitoes, and continued our tramp to the foot of Walker's Pass. A steep climb of 800 ft. through bush and a walk of a mile on slightly rising ground brought us to the middle of the Pass, where we crossed the main divide between Canterbury and Westland. We were most interested in the sudden glimpse of the summit of Mt. Franklin through a gap in the range ahead of us, for one of the objects of our trip was to endeavour to climb this mountain, which is 7,000 ft. in height, and hitherto had been conquered only from the opposite side to that on which we approached it.



A willing horse! A well-laden climber during a tramp through the mountains of the South Island of New Zealand.

Two hours of heart-breaking toil enabled us to reach a saddle from which a magnificent view of several peaks of the range was obtained, but a gorge running right up the mountain side prevented our efforts to climb Mt. Franklin by this new route. Abandoning the attempt, therefore, we looked around for a camp site. Directly below us was Taruahuna Pass, its floor raised about 200 ft. by a gigantic mass of rock that had slipped away from Falling Mountain. We made our way into the Pass by a steep descent of 500 ft., and after a tiring struggle over a mile of the debris brought down by the landslide we reached grassland on which we could set up our tent.

Next morning we were late in starting, for our climb on the previous day had exhausted us. We followed a deer track through the thick bush, where low hanging branches dragged at our backs and our tempers were ruffled by the heat and the attacks of insects. As darkness was falling we came out into the open, having taken four hours to cover three miles of bush. We soon had a cheerful fire blazing and settled down for the night.

We were now practically at the end of our tramp, and next day a short walk brought us to huts erected at Bealey Quarry, where we stayed a few days before returning to Christchurch by train.

R. Burbery (Lyttelton, N.Z.).

Visiting the Farne Islands

Recently I was rowed from Sea Houses, on the Northumberland Coast, to the Farne Islands. The sea was pleasantly rough as we headed for Navestone Island, where the boatman had sighted a school of seals. Unfortunately we were unable to approach sufficiently near enough to obtain a really good view of these interesting creatures. We therefore rounded Navestone and returned to Longstone, the scene of Grace Darling's famous exploit. After a short stay there we rowed across to other islands that are famous bird sanctuaries. On one of them were hundreds of gulls of many kinds, and there I obtained a lesser black-backed gull's egg and saw hundreds of other eggs lying unprotected in the nests. Arctic swallows and eider-ducks were chiefly to be seen on the second island, and it was wonderfully interesting to see these birds, and those on the other islands of the group, in a place that they could claim as their own.

J. B. Craggs (Gosforth).

Model Motoring For All

The Fascinating Meccano Car Constructor

AT this time of the year Meccano boys begin to think of outdoor sports and amusements, and the keen model-builder naturally looks for some open-air pastime or hobby that will take the place of his indoor model-building activities. Nowadays there is a big variety of outdoor recreations, but undoubtedly one of the most fascinating is model car operation with cars built from Meccano Motor Car Constructor Outfits. Many thousands of Meccano boys are proud possessors of these Outfits, but although they obtain a great deal of fun by running their cars indoors, probably many have not realised the wonderful possibilities that the use of the car out of doors affords.

A Meccano Motor Car Constructor Outfit actually provides an ideal hobby for the Spring and Summer months, as it enables many fascinating hours to be spent in the open air operating the models built with the Outfit, while at the same time it provides the model-builder with constructional work when it is not possible to be out of doors. Many interesting racing events, competitions, experiments, etc., can be arranged for the models, and in this article we deal with this interesting aspect of Meccano model motoring. Some useful hints regarding construction and adjustment are also included, so that constructors may obtain the maximum efficiency from their cars.

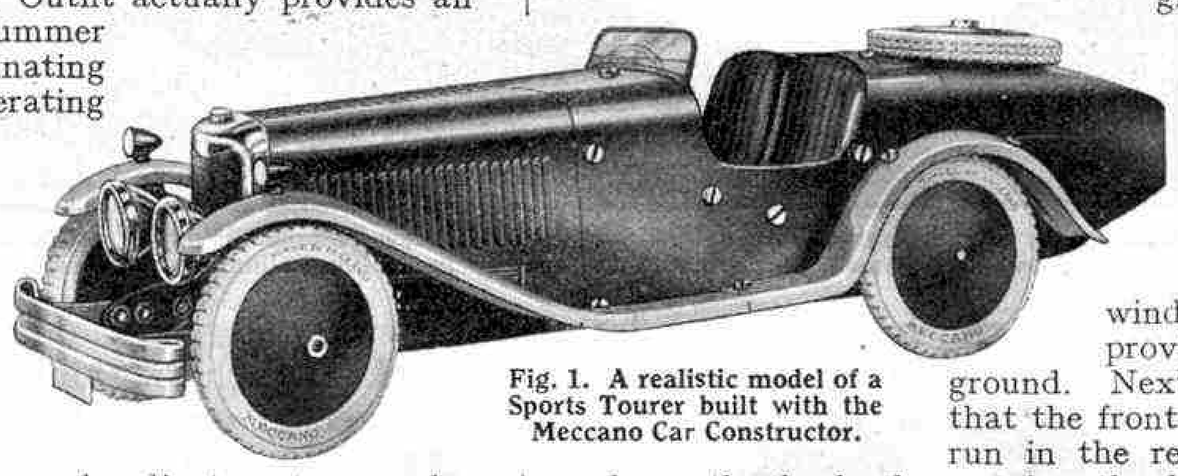


Fig. 1. A realistic model of a Sports Tourer built with the Meccano Car Constructor.

The Meccano Motor Car Constructor, although introduced only last year, has already achieved remarkable popularity, and a big proportion of our readers will now be familiar with its general design. For the benefit of those who are not, however, we include a short description of the Outfit and the different speed cars that can be built by means of it.

Each Motor Car Constructor Outfit contains a complete set of miniature automobile parts with which realistic models of sports and speed cars may be built. Some of the parts in the Outfit are enamelled in colours, while others are chromium plated, so that a car built up from the Outfit has a particularly handsome appearance.

The realistic effect has not been achieved at the expense of adaptability, however, as many of the parts, such as body sections, Mudguards, Radiator, Spare Wheel, may be changed so as to produce different types of cars. In addition it is possible to shorten or lengthen the wheelbase of the car, so that a model of a big sports tourer, or of a light speed model with a shorter wheelbase, may be assembled as desired.

The Meccano Motor Car Constructor can be obtained in four distinct colour schemes, red and cream, light blue and cream, green and yellow, and red and light blue, so that the model motor-builder may express his ideas in regard to the appearance of his models.

While the Meccano Motor Car has a particularly fine external appearance, the internal mechanical features and motor drive are none the less interesting. The steering gear is of the worm and nut type, the steering bell crank being connected to a track rod that is attached to the front road wheel stub axles in a similar manner to an actual car. The brake is of the internal expanding type operating on a drum on the rear wheel, and provides a very powerful braking action. The spring Motor with which the car is powered has been specially designed to provide a long run at high speed, and some idea of its efficiency can be gained from the fact that it will drive the model for a distance of 150 feet, at a scale speed of approximately 100 m.p.h. Full instructions for building up the car with the Motor Car Constructor parts are contained in the special Instructions supplied with the Outfit, and no difficulty should be experienced in assembling a model if the instructions are followed.

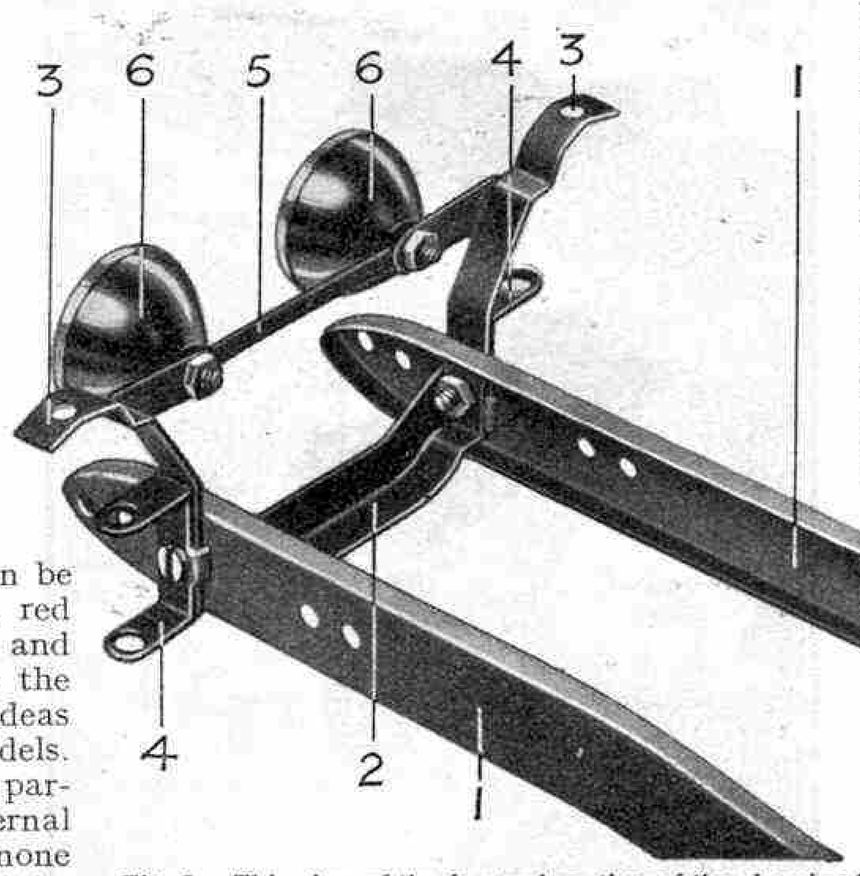


Fig. 2. This view of the forward portion of the chassis of the car shows how closely the special Motor parts resemble actual automobile units.

Before giving the completed car a trial run, the various moving portions should be inspected in order to make sure that they are adjusted correctly. A hall or passage may be used for running the car, but by far the most satisfactory type of "test ground" is a stretch of smooth concrete or asphalt. A garden path having a smooth hard surface is also suitable, but the car will not run well on a gravel or other loose surfaced track owing to the high frictional resistance between the wheels and the ground. In addition, loose particles of gravel or sand are liable to enter the clockwork mechanism, with a detrimental effect on the running of the car.

To operate the model, first place the brake in the "on" position by drawing the Brake Lever toward the rear of the car. Then wind up the motor with the key provided and place the car on the ground. Next turn the steering wheel so that the front wheels are set for the car to run in the required direction, and finally release the brake by moving the brake lever into the forward position. The car will then commence to move forward, gradually gathering speed until it is running "flat out." It will continue to travel at top speed until the spring motor is practically unwound, when it will slow down and finally come to rest.

The length of run obtained with the model depends of course on the smoothness or otherwise of the ground, but it is affected also by the angle at which the front wheels are set. If the car is arranged to travel in a straight line, the full run of 150 ft. will be obtained on a good surface. On a circular course the length of run is reduced to some extent on account of the increased friction between the road wheels and the track. If the steering wheel is turned so that full right-hand or left-hand lock is obtained, the car can be made to run in a very small closed circuit, but the friction in turning at such a sharp angle will reduce the speed to a considerable extent.

After the steering of the car and brake operation have been mastered fully, the constructor will be keen to enter his model in competition with model cars built by his friends. Some very exciting races can be arranged, and when several cars are entered in an "event," the effect is very thrilling. For the best effect, a fairly large open space such as a concrete or asphalt playground is required, but where this is not available, "lap" races in which the model cars make a fixed number of circuits of a relatively short course can be staged with interesting results.

In an actual race the competing cars are lined up at the starting point, each one occupying a space marked off on the ground. Model-builders may reproduce this feature by marking out spaces on the ground in which the model cars must be placed before the commencement of the race; strips of white paper can be used for this purpose.

Several "course officials" should be appointed before the commencement of the race, and they are responsible for giving the starting signal and recording the winning car at the finishing end of the course, while they must also see that no "rules" are broken while the race is in progress. The cars may be started by "flagging off." A suitable flag can be made from paper or cloth, and this is held by the starter. At the required moment he lowers the flag,

and the cars are started by their respective operators. A toy cap pistol may also be used for starting purposes.

A quick start is of vital importance in a model race, especially if the course is not a very long one, and each operator should therefore be ready to release the brake of his model on the instant the signal is given. The best way of doing this is to hold the car in position by resting the left hand on the rear portion of the bodywork, while the Brake Lever is held by the fingers of the right hand. The instant the starting signal is given the Brake Lever is pushed forward, thus releasing the rear axle, so that the model may speed away.

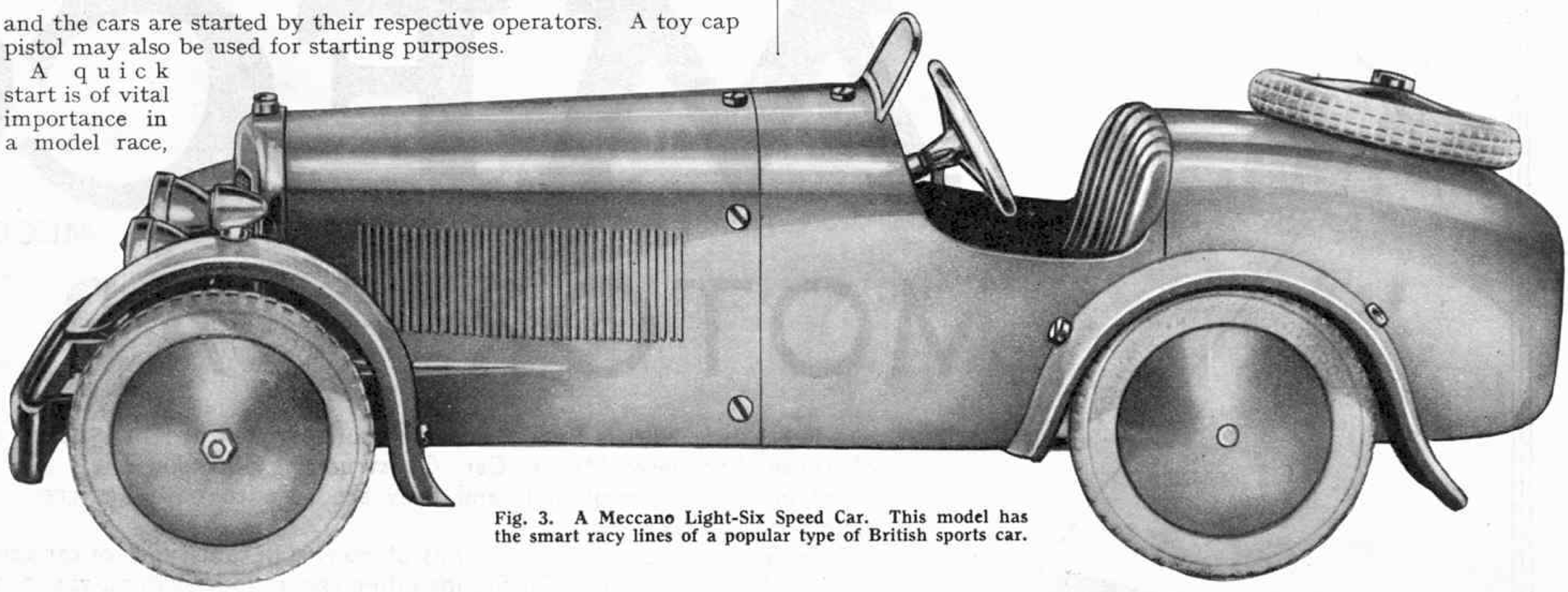


Fig. 3. A Meccano Light-Six Speed Car. This model has the smart racy lines of a popular type of British sports car.

When a " lap " event is being run, the winner of the race cannot be identified as easily as in a straight circuit, as the model car that has completed the full number of laps may lie behind another car with a lower number of laps to its credit, the latter consequently giving the impression of being the winner. It is here that the " course officials " play their part by noting carefully the number of laps completed by each car entered in the race. The winning car may be " flagged in " with a chequered flag.

The various colour combinations in which the Meccano Motor Car can be produced will generally enable the different entries to be distinguished easily during a race. In a big race, however, in which many Meccano Cars are entered, it is a good plan to fix discs of white card to the sides of the bodywork of the cars, distinguishing numbers being painted on these discs in black. In doing this Meccano boys will be following actual motor racing practice, as the entries in big racing events are marked in this way.

Fig. 4. The Meccano Garage.

Mention of distinguishing marks brings us to an addition that will give an individual touch to the car—the painting of registration numbers on the Front and Rear Number Plate of the machine. The Number Plates of the Meccano Motor Car are supplied blank, so that constructors may insert any number they desire. They may, for instance, fill in the registration number of their father's car, or of that of a friend who owns an attractive sports or racing machine. The figures may be painted on the Number Plates in Chinese white water colour, a fine brush being used so as to obtain a neat effect. If a more permanent result is desired, white oil colour mixed with a little turpentine may be used.

Turning once again to the subject of model races, some readers may be inclined to think that competitive events in which Meccano Cars are entered will result in " dead heats," owing to the fact that the motive power, steering mechanism, etc., are identical. This is not the case, however. All Meccano Cars when correctly assembled will have practically the same performance as regards speed and length of run, but the final adjustment and lubrication of the mechanism rests with the owner, and the model-builder who pays particular attention to the " tune " of his car will enable it to outdistance less well-adjusted models.

In tuning the car so as to obtain the maximum efficiency, the most important point is to see that there is no stiffness in the drive from the Contrate on the spring motor to the road wheels. The Collars that hold the Rear Axle in position should be adjusted so that the Axle can turn freely; too much lateral play must not be allowed, however, as this will result in irregular running. The Driving Pinion mounted on the Rear Axle must engage the teeth of the Contrate smoothly, and in order to ensure that no slip takes place between the Pinion and the shaft, a depression is cut in the Axle, into which the grub-screw of the Pinion should be driven. For maximum speed there must, of course, be no retarding or braking effect, and it is therefore important to see that the drum of the internal-expanding brake does not touch the Rear Wheel at any point when the brake is in the " off " position, with Brake Lever pushed forward.

If the brake mechanism has not been assembled correctly there will be a tendency for the Drum to press against the Wheel flange. This mechanism is assembled as follows. The end of the Brake Rod is first pushed into position in the Brake Drum by passing it between the securing flange and the rim, care being taken to see that the Brake Lever is on the inside of the Brake Rod when the unit is attached to the Car. The Lever is pushed forward until the narrow portion of the cam end is opposite the opening in the rim, and is then slipped into place. With the Drum held in one hand, the Brake Rod is drawn outward so that the second fixing hole in the lug of the Drum is uncovered. The Brake Drum is now bolted to the car by $\frac{1}{4}$" Bolts, which also serve to hold the Rear Mudguard Brackets in position.

The Brake Lever is mounted on the special $\frac{5}{16}$" Bolt and held in place by means of a nut. In assembling the rear road axle, the right-hand Rear Wheel is first secured on one end of the Axle by means of its grub-screw, and the Axle is then pushed through the bearing in the right-hand side of the Frame, the Collars and Driving Pinion being slipped on before the Axle is pushed through the left-hand side of the Frame. Finally the left-hand Rear Wheel is mounted in place on the projecting end of the Axle.

The Meccano Car, like a real car, must be carefully lubricated from time to time in order to reduce friction and wear to a minimum. The special Meccano Oil should be used for this purpose, and this may be applied by means of either the No. 1 or the No. 2 Oilcan, the No. 2 Oilcan being particularly suitable for use with the car as it is a correct scale model of the actual " K " type engineer's oilcan used in many garages and motor works. Oil should be applied to the teeth of the Contrate Wheel and driving Pinion and to the Rear Axle bearings, and a little also to the steering gear and front road axles. Oil must not be allowed to reach the Brake Drum, as this will cause slipping.

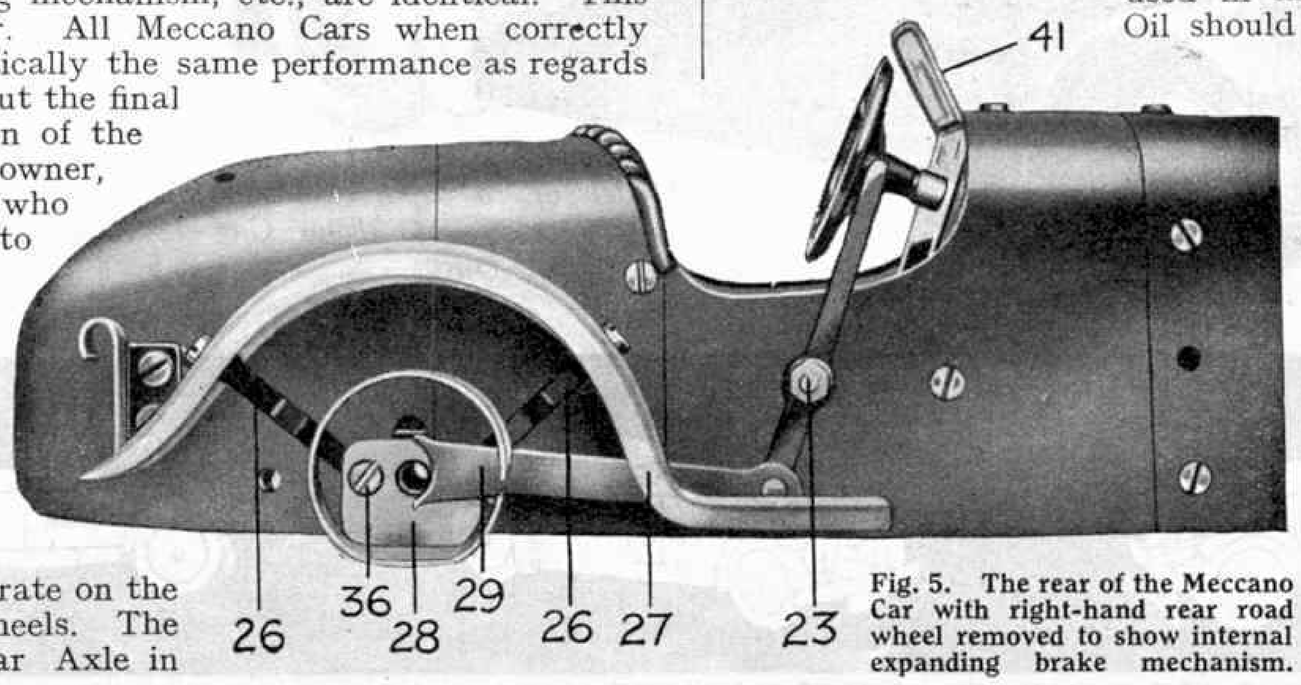


Fig. 5. The rear of the Meccano Car with right-hand rear road wheel removed to show internal expanding brake mechanism.

Meccano model motoring would not be complete without some means of accommodating the car when not in use, and the Meccano Garage has been produced for this purpose. Another interesting addition is the Car Lighting Set, which enables the Headlamps of the model to be fitted with electric lights.

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MOTOR CAR C

Every boy who is keen on model building will ardently desire one of these fine new Motor Car Constructor Outfits. They are the latest Meccano development and they are sure to have an irresistible appeal for all boys.

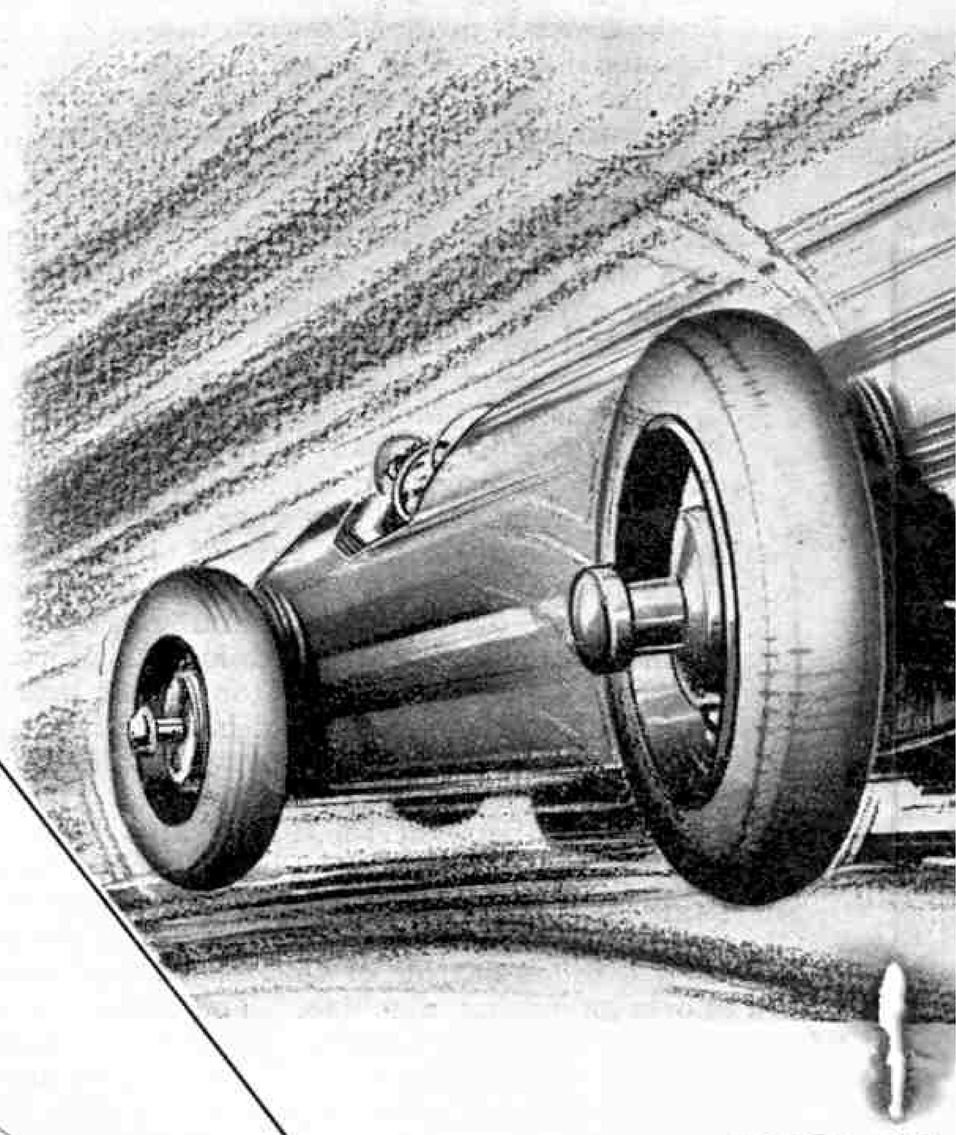
Perfect miniature reproductions of many different types of car can be built with these splendid Outfits including sports four-seaters, speed cars, sports coupés and others. All the models are fitted with a powerful clockwork drive and a steering gear that functions perfectly. The parts are finished in rich enamel and nickel-plate, the complete Outfits being masterpieces of miniature automobile craftsmanship.

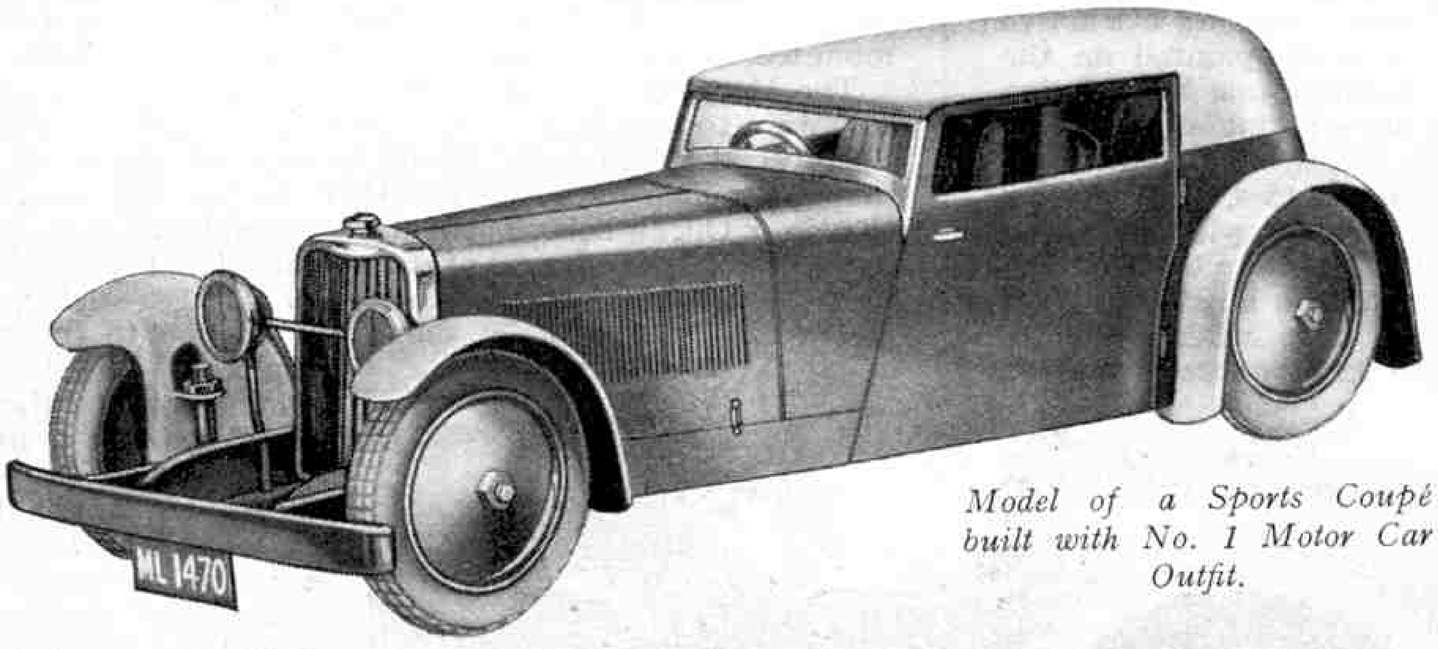
No. 1 MECCANO MOTOR CAR CONSTRUCTOR OUTFIT

The motor car models that can be built with this Outfit are the finest you ever saw. Look at the example illustrated below and think of the fun you could have building this and other types equally graceful and realistic.

No. 1 Outfit is available in four different colour combinations—Red and Light Blue, Light Blue and Cream, Green and Yellow, and Cream and Red. It is supplied complete with powerful Clockwork Motor.

Price **14/6**





Model of a Sports Coupé built with No. 1 Motor Car Outfit.

MOTOR CAR

The Meccano Motor Car Garag
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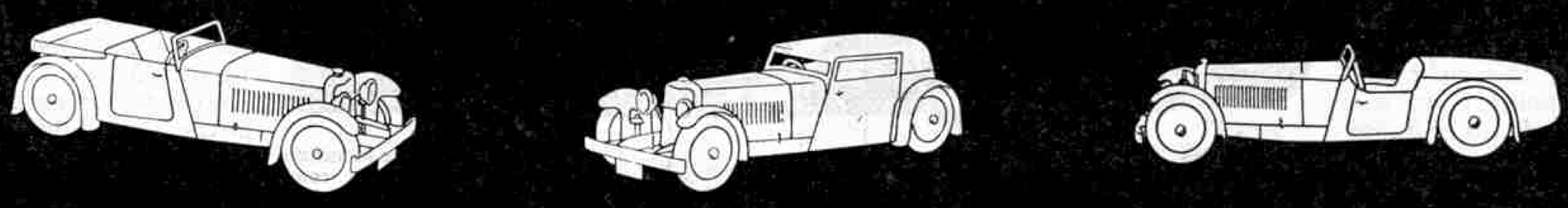

THE ABOVE ARE EXAMPLES OF MODELS MADE WITH MECCANO MOTOR CAR OUTFIT No. 1.

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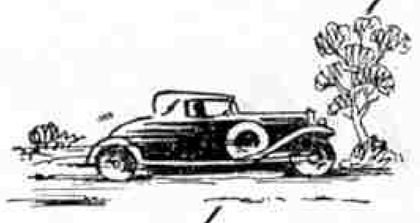
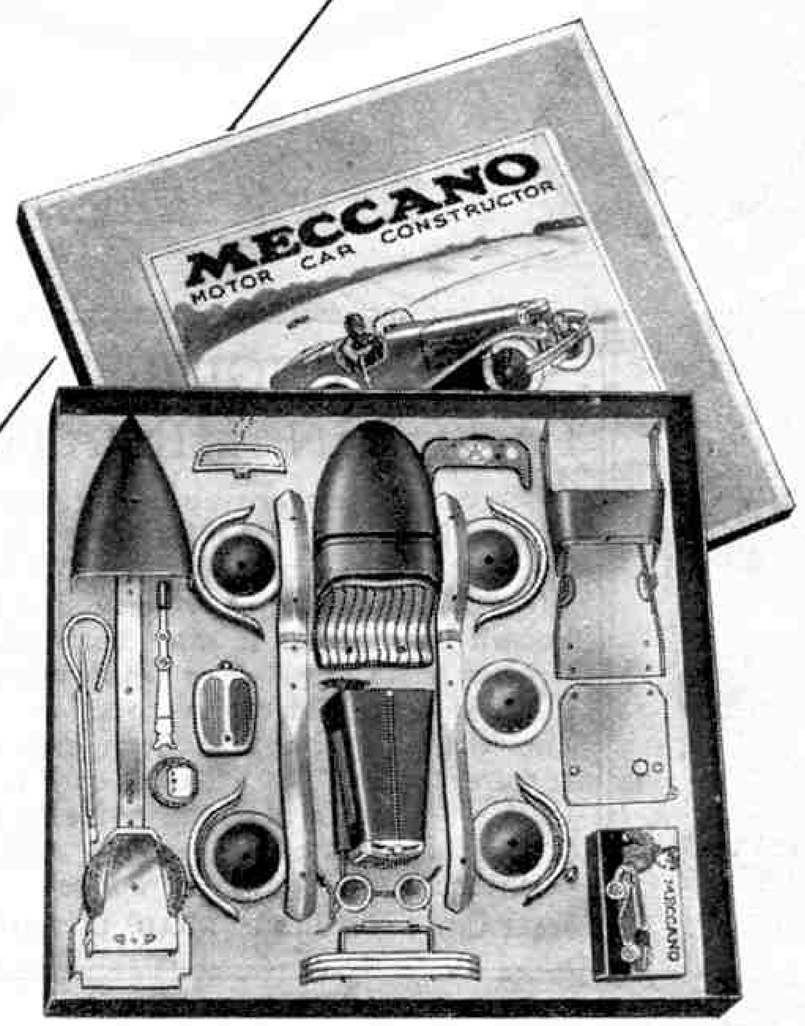
CONSTRUCTOR



Now is the time to get a Meccano Motor Car Outfit. You will never grow tired of building and running the superb models that you will be able to build. Make up your mind to get one of these splendid Outfits, and see your dealer about it to-day.

Each Meccano Motor Car Outfit is available in four different colour combinations—Red and Light Blue, Light Blue and Cream, Green and Yellow, and Cream and Red. In addition, the following parts will be available separately in the colours indicated. Body: Orange; Yellow. Wheels: Orange; Yellow. Wings: Orange; Green.

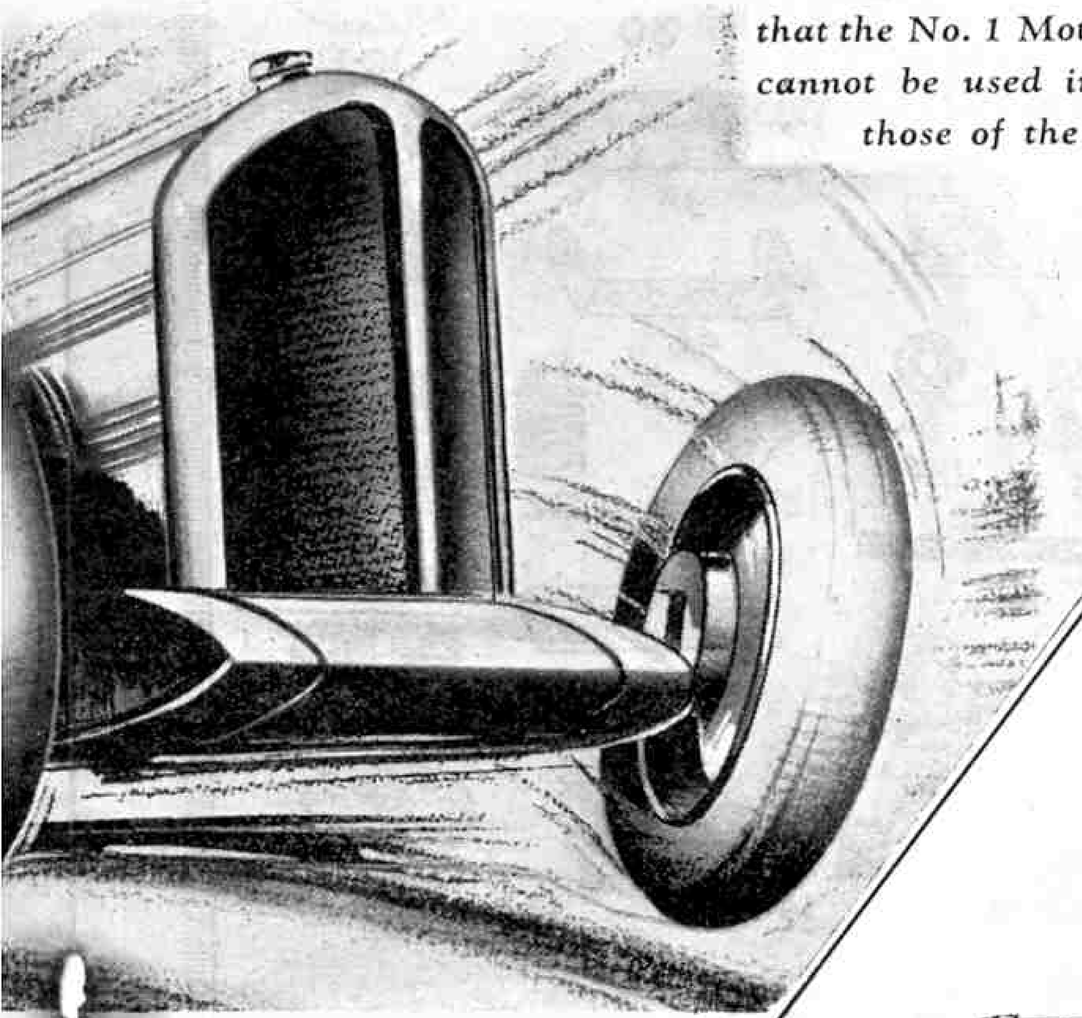
IMPORTANT. It should be noted that the No. 1 Motor Car Outfit parts cannot be used in conjunction with those of the No. 2 Outfit.



No. 2 MECCANO MOTOR CAR CONSTRUCTOR OUTFIT

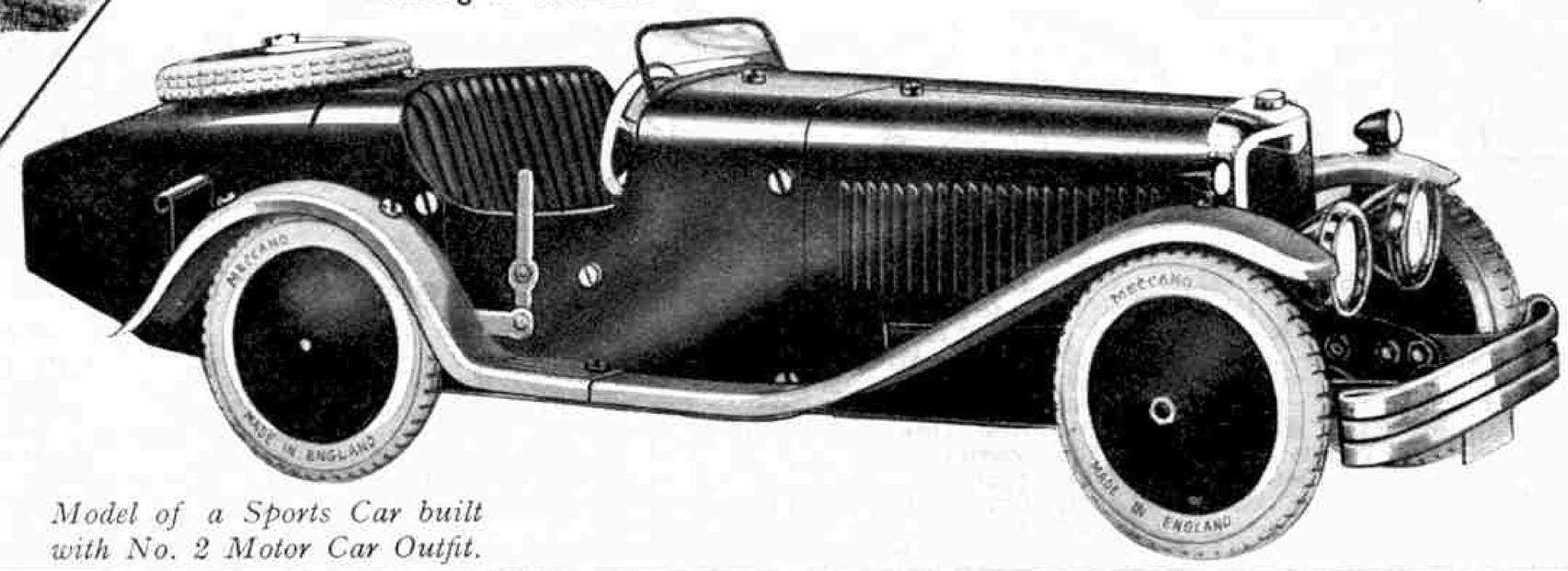
Larger models of a superior type can be built with No. 2 Outfit. They are perfectly designed, beautifully finished and the most attractive examples of constructional engineering ever invented for the delight of boys. Their handsome and realistic appearance may be judged from the illustration below.

No. 2 Outfit is available in four different colour combinations—Red and Bright Blue, Light Blue and Cream, Green and Yellow, and Cream and Red. A powerful Clockwork Motor that gives a run of 150 feet on one winding is included. Price **25**/-



OR CAR GARAGE

Car Garage provides accommodation car. It is strongly built, and its an extremely attractive appearance. Price **7**/-



Model of a Sports Car built with No. 2 Motor Car Outfit.

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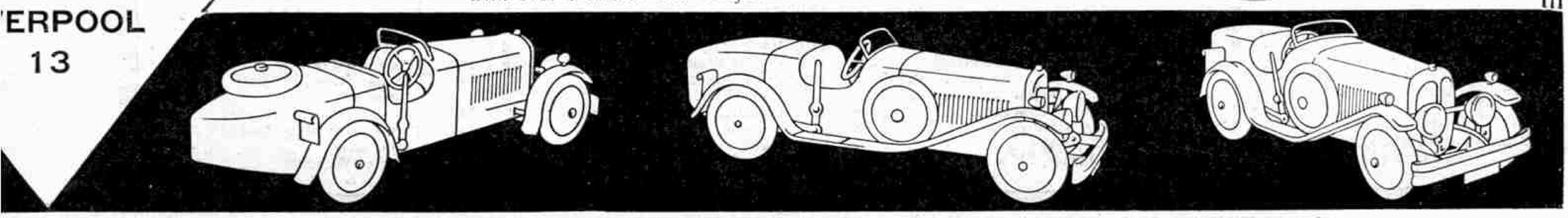
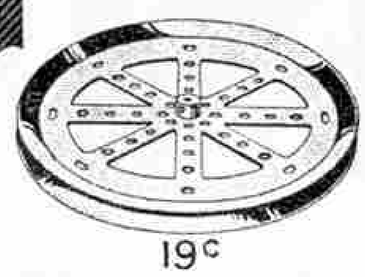


THE ABOVE ARE EXAMPLES OF MODELS MADE WITH MECCANO MOTOR CAR OUTFIT No. 2.

MECCANO ACCESSORY PARTS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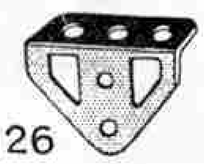
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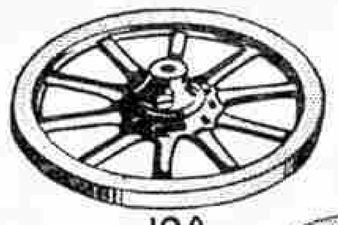
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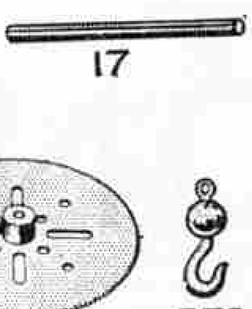
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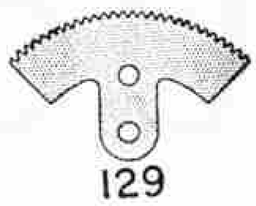
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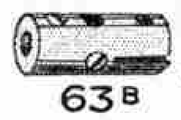
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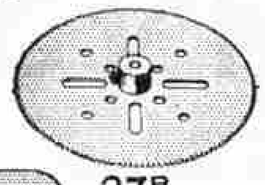
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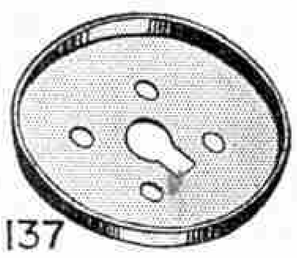
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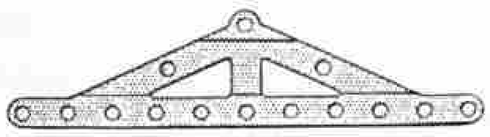
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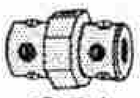
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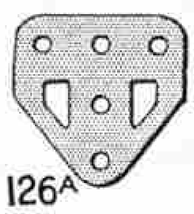
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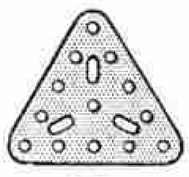
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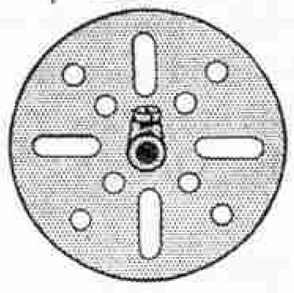
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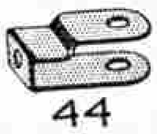
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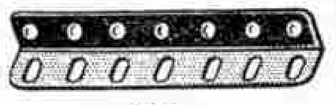
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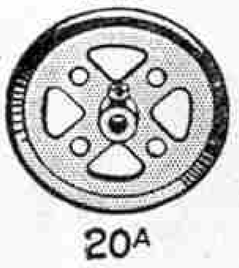
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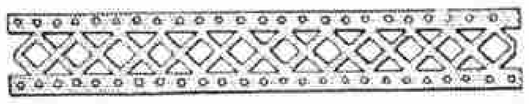
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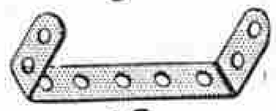
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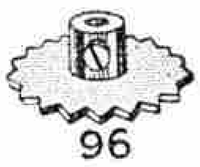
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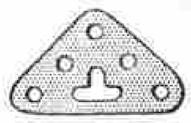
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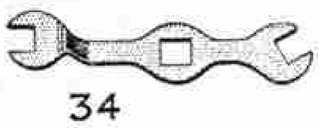
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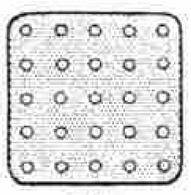
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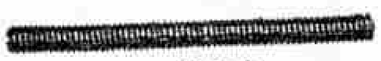
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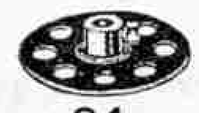
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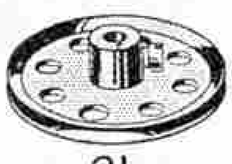
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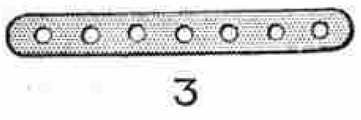
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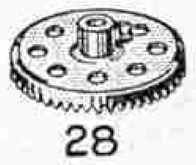
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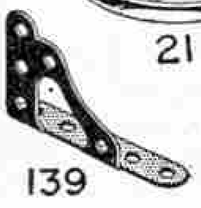
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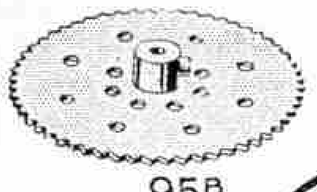
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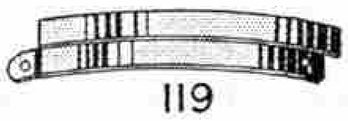
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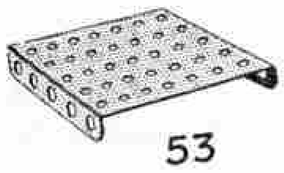
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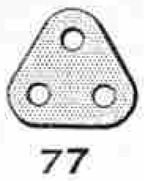
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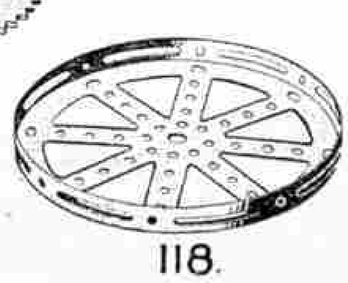
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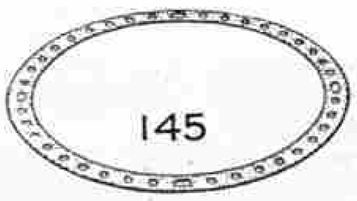
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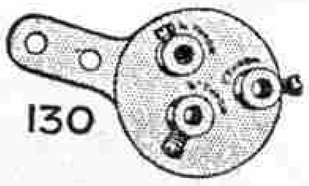
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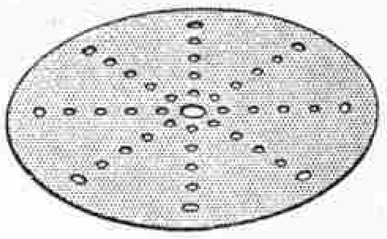

146

No.		s.	d.
3.	Perforated Strips, 3½″ long ... ... ½ doz.	0	4
9b.	Angle Girders, 3½″ long „	0	8
17.	Axle Rods, 2″ long ... 3 for	0	1
19a.	Wheels, 3″ diam., with set screws ... ... each	0	6
20.	Flanged Wheels, 1⅛″ diam. „	0	5
	Pulley Wheels with centre boss and set screw :		
19b.	3″ diam. ... ... each	0	7
19c.	6″ „ ... ... „	2	0
20a.	2″ „ ... ... „	0	5
21.	1½″ „ ... ... „	0	4
22.	1″ „ ... ... „	0	3
23a.	½″ „ ... ... „	0	3
	Pulley Wheels without centre boss and set screw :		
22a.	1″ diam. ... ... each	0	2
23.	½″ „ ... ... „	0	2
24.	Bush Wheels ... ... „	0	4
27a.	Gear Wheels, 57 teeth to gear with ½″ pinion ... „	0	6

No.		s.	d.
27b.	Gear Wheels, 133 teeth to gear with ½″ pinion (3½″ diam.) ... ... each	1	3
28.	Contrate Wheels, 1½″ diam. „	0	9
29.	„ „ ¾″ „ „	0	6
30.	Bevel Gear, ¾″, 26 teeth „	0	9
31.	Gear Wheels, 1″, 38 teeth „	1	0
32.	Worms ... ... „	0	5
34.	Spanners ... ... „	0	2
44.	Cranked Bent Strips ... „	0	1
45.	Double „ „ ... „	0	1
46.	Double Angle Strips, 2½″ × 1″ ... ... ½ doz.	0	6
53.	Perforated Flanged Plates, 3½″ × 2½″ ... each	0	3
55.	Perforated Strips, slotted, 5½″ long ... . „	0	2
57b.	Hooks, Loaded ... ... „	0	2
63a.	Octagonal Couplings ... „	0	8
63b.	Strip Couplings ... ... „	0	8
65.	Centre Forks ... ... „	0	1
72.	Flat Plates, 2½″ × 2½″ ... „	0	2

No.		s.	d.
76.	Triangular Plates, 2½″ each	0	2
77.	„ „ 1″ „	0	1
80a.	Screwed Rods, 3½″ ... „	0	3
90a.	2½″ Curved Strips, cranked, 1⅝″ radius, 4 to circle „	0	1
94.	Sprocket Chain, per 40″ length	0	6
95.	Sprocket Wheels, 36 teeth, 2″ diam. ... ... each	0	5
95b.	Sprocket Wheels, 56 teeth, 3″ diam. ... ... each	0	6
99.	Braced Girders, 12½″ long ½ doz.	2	6
103d.	Flat Girders, 3½″ long „	0	7
109.	Face Plates, 2½″ diam. each	0	4
110.	Rack Strips, 3½″ ... ... „	0	2
113.	Girder Frames ... ... „	0	3
116.	Fork Pieces, Large ... „	0	3
118.	Hub Discs, 5½″ diam. „	1	3
119.	Channel Segments (8 to circle, 11½″ diam.) ... „	0	4
120.	Buffers ... ... „	0	2
123.	Cone Pulleys ... ... „	1	3

No.		s.	d.
125.	Reversed Angle Brackets, ½″ ... ... ½ doz.	0	3
126.	Trunnions ... ... each	0	2
126a.	Flat Trunnions ... ... „	0	1
128.	Boss Bell Cranks ... „	0	3
129.	Rack Segments, 3″ diam. „	0	5
130.	Eccentrics, Triple Throw „	1	0
132.	Flywheels, 2¾″ diam. „	2	0
133.	Corner Brackets, 1½″... „	0	1
136.	Handrail Supports ... „	0	3
137.	Wheel Flanges ... ... „	0	3
139.	Flanged Brackets (right) „	0	2
140.	Universal Couplings ... „	0	10
143.	Circular Girders, 5½″ diam. ... ... „	1	0
144.	Dog Clutches ... ... „	0	6
145.	Circular Strips, 7½″ diam. over all ... ... „	0	9
146.	Circular Plates, 6″ diam. „	1	0
147.	Pawls, with pivot bolt and nuts ... ... „	0	3
148.	Ratchet Wheels ... „	0	6

REAL ENGINEERING PARTS IN MINIATURE

Meccano parts, a number of which are here illustrated, combine to form a complete miniature engineering system with which practically any movement known in mechanics may be duplicated.

New parts are always being introduced in order to keep Meccano model-building in line with the most modern engineering requirements. The greatest care is taken in the designing of these parts to ensure that they function exactly as their counterparts in actual practice.

MECCANO LTD., BINNS ROAD, LIVERPOOL 13

Model-Building Competition Results

By Frank Hornby

"Autumn" Contest (Overseas Section)

The full list of awards that have been made in the Overseas Section of the "Autumn" Model-building Contest is as follows :—

FIRST PRIZE, Cheque for £3-3s.: G. Brown, Brisbane, Australia. SECOND PRIZE, Cheque for £2-2s.: Pablo Giese, Buenos Aires. THIRD PRIZE, Cheque for £1-1s.: J. Pienaar, Johannesburg.

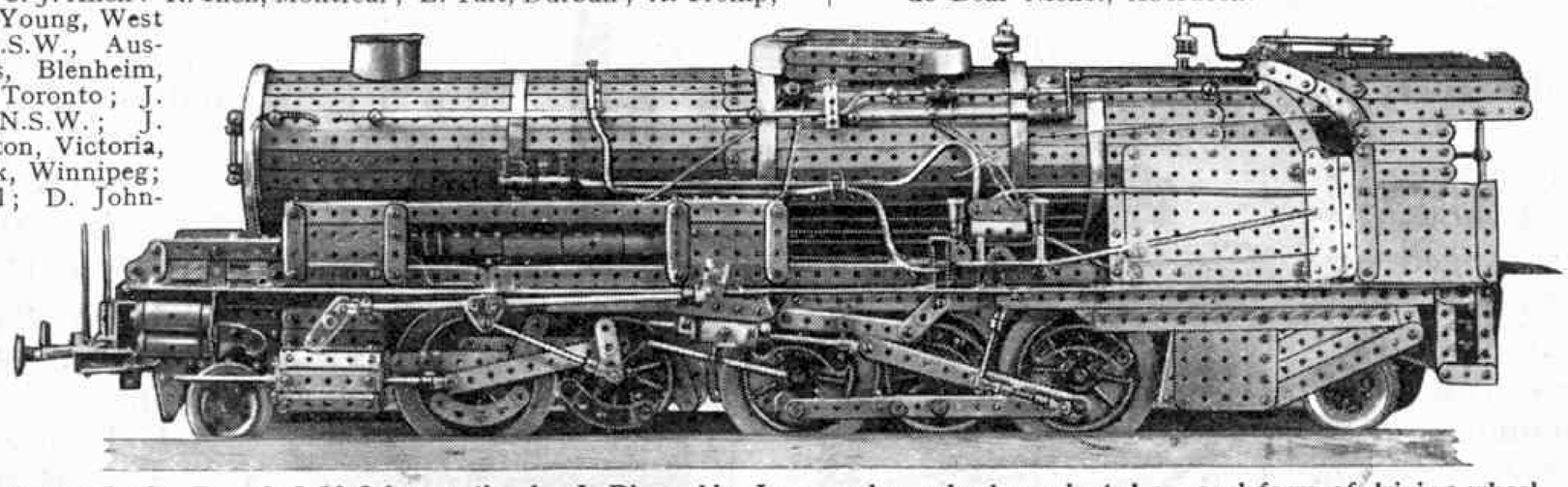
SIX PRIZES of Meccano or Hornby Train goods value 10/–; J. Ringnalda, Leeuwarden, Holland; H. v. Dommelen, Antwerp, Belgium; M. Sanglas, Barcelona; C. Taylor, Ashburton, N.Z.; J. Urteaga, Santiago, Chile; G. Dalvit, Buenos Aires.

SIX PRIZES of goods value 5/–: J. Pouptis, Athens, Greece; S. Clack, Johannesburg; A. Pacheco, Santiago, Chile; P. Visser, Oosterbeek, Holland; A. Hemiksen, Horten, Norway; J. Oleaga, Buenos Aires.

"*Famous Trains*" by C. J. Allen: R. Inch, Montreal; E. Tait, Durban; A. Trollip, Johannesburg; R. Young, West Pennant Hills, N.S.W., Australia; K. Orams, Blenheim, N.Z.; F. Hinbest, Toronto; J. Barron, Sydney, N.S.W.; J. Churchward, Brighton, Victoria, Australia; J. Cesak, Winnipeg; W. Scott, Montreal; D. Johnston, Wellington, N.Z.; A. Ness, Port Dalhousie, Ontario.

MECCANO ENGINEERS' POCKET BOOKS AND CERTIFICATES OF MERIT: D. Mills, Durban; Q. Hamilton, Trinidad; J. Pons, Barcelona; V. Garino Canina, Torino, Italy; P. Tumiati, Milan; G. Giovanni, Pisa, Italy; C. Ceasar, Trinidad.

CERTIFICATES OF MERIT: D. Nelson, Masterton, N.Z.; V. Pellivrari, Milan; E. Williamson, Utiku, N.Z.; B. Hyde, Johannesburg; P. Williams, Johannesburg; M. Orde, Chateau d'Oex, Switzerland; J. Butchers, Wellington, N.Z.; K. Winch, Kilkenny, S. Australia; R. Napier, Salisbury, S. Rhodesia; M. Ghislain, Houdeng-Aimeries, France; R. Schuddebeurs, Schiedam, Holland; R. Cain, Durban; J. Blaanboer, Rotterdam; J. Listom and G. Petersen (joint entry), Cape Town; H. Denholm, Hobart, Tasmania; R. Rasmussen, Bergen, Norway; E. Cauchi, Sliema, Malta; W. Beard, Cleveland, S.A.; C. Dalvit, Buenos Aires; I. Ellefsen, Plumstead, S.A.; H. Inwood, Christchurch, N.Z.; A. Felmine and R. Rattan (joint entry), Trinidad; Miss A. Hamilton, Trinidad.



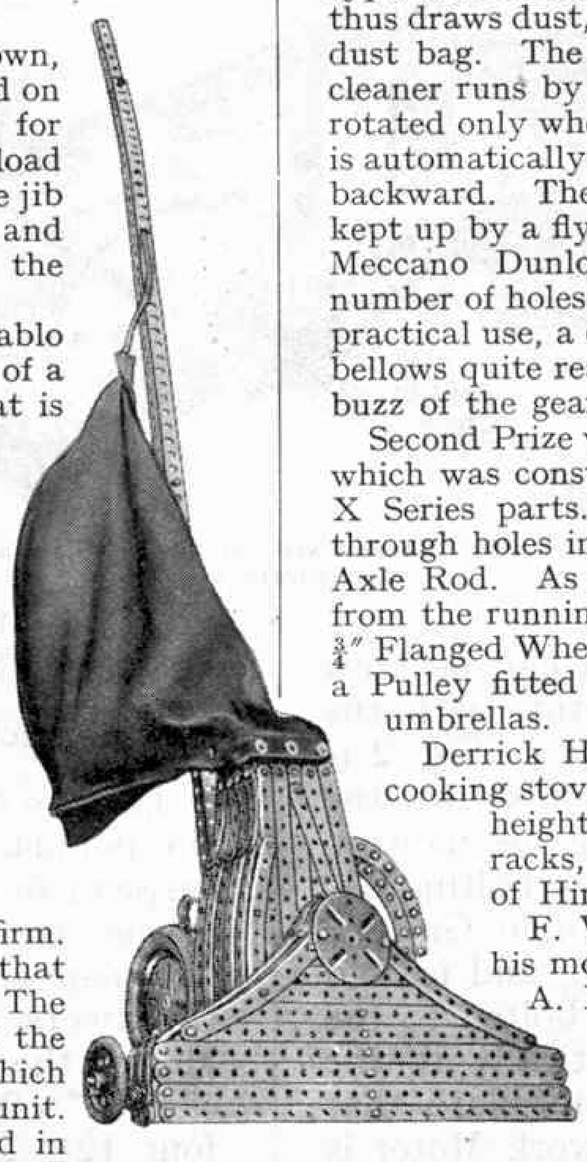
A model of a French 2-10-2 locomotive by J. Ringnalda, Leeuwarden, who has adopted a novel form of driving wheel construction that makes use of the small Circular Plates and Artillery Wheels.

First prize in this contest was won by G. Brown, Brisbane, with a large model of a crane, which is based on the fine floating crane described in the "*M.M.*" for February, 1932. The jib is equipped with three load blocks, two of which are suspended from pulleys at the jib head and handle the heavy loads, while the third and smallest block is suspended from the middle of the jib and handles the smaller loads.

Second Prize went to an Argentine competitor, Pablo Giese of Buenos Aires, and was awarded for a model of a single-funnelled liner, of which the only portion that is open to criticism is the stern. This is formed from Braced Girders bent to shape, but as these parts are not suited to this kind of work they form rather an eye-sore and adversely effect the appearance of the remainder of the model. The deck work and the bridge construction is beautifully carried out, and it was this feature that earned the model its success in this Contest.

The Third Prize entry is of a more uncommon type, and was built by J. Pienaar, Johannesburg. It consists of two individual models, a portable steam engine and a mealie sheller. The latter is an agricultural machine familiar in the maize-growing parts of South Africa, and is modelled after an actual machine manufactured by a British firm. An outstanding feature of the sheller is an elevator that conveys the maize into the shelling mechanism. The elevator swivels about a pivot fixed to the top of the sheller framework and consists of an endless belt, which is driven by Sprocket Chain from the steam engine unit. The steam engine is in itself a splendid model, and in conjunction with the sheller it forms a very pleasing and original type of entry.

A fine model locomotive, in which many novel constructional features appear, won a prize for J. Ringnalda.



A "Whirlwind" type Carpet Cleaner that won First Prize in the "Home Objects" Contest (Section A). The model is the work of E. A. Stevens, Sutton, Surrey.

"Home Objects" Contest (Sections A and B)

This Contest, no doubt on account of its novel character, attracted a very large number of entries, many of which are ingeniously constructed and show that even the most commonplace objects hold interest for the enthusiastic model-builder. The prizes have been awarded as follows :—

Section A (for competitors over 14 years of age).

FIRST PRIZE, Cheque for £3-3s.: E. A. Stevens, Sutton, Surrey. SECOND PRIZE, Meccano or Hornby Train goods value £2-2s.: C. Spencer, Warsash, Hants. THIRD PRIZE, goods value £1-1s.: D. Holloway, Squirrels Heath, Essex.

FIVE PRIZES of goods value 10/6: R. Dale, Jersey, Channel Islands; S. Wotherspoon, Waterloo, Liverpool; C. Williams, Manchester; L. Hollyoak, Coventry; B. de Bear Nichol, Aberdeen.

TEN PRIZES of goods value 5/–: J. Heeler, Watford; G. Cory, Cheltenham; W. Cavanagh, Offaly, Ireland; M. McDonald, Ranelagh, Dublin; F. Margerison, Blackburn; R. Storrar, Letham Ladybank; G. King, London, S.W.17; J. Ffoulkes, Ilford; R. Hogg, London, S.W.12; D. Brooks Alveston, Bristol.

Section B (for competitors under 14).

FIRST PRIZE, Cheque for £2-2s.: F. W. Hole, Taunton, Som. SECOND PRIZE, Meccano or Hornby Train goods value £1-1s.: A. Le Claire, Worksop, Notts. THIRD PRIZE, goods value 10/6: D. Leadbeater, Horsforth, Leeds.

TEN PRIZES of goods value 5/–: J. Morris, Chatham, Kent; W. Pegum, Kilelton, Ballylongford, Ireland; A. Trenholm, Eaglescliffe, Co. Durham; G. Tarry, Binfield, Berks.; G. Heeler, Watford; A. Clark, Worthing; F. Holmes, Nottingham; M. West, London, S.W.5; J. Knapman, Highams Park, Essex; G. Sizer, Retford, Notts.

First Prize in the senior Section was awarded for a model of a "Whirlwind" vacuum cleaner. The cleaner is of the non-electric type, and consists of a suction fan that is rotated at high speed and thus draws dust, etc., up an induction tube into a specially arranged dust bag. The fan is driven from the rear wheels on which the cleaner runs by means of ratio 18 : 1 step-up gearing. The fan is rotated only when the cleaner is pushed in a forward direction, and is automatically decoupled from the drive when the cleaner is pulled backward. The speed of the fan during the time it is decoupled is kept up by a flywheel consisting of a 3" Pulley Wheel fitted with a Meccano Dunlop Tyre on the fan-shaft. Although the large number of holes in the casing prevents the model from being of any practical use, a considerable draught is produced, and the dust bag bellows quite realistically, to the accompaniment of a business-like buzz of the gearing. The fan is built up from Propeller Blades.

Second Prize was awarded for a "Ewbank" type carpet sweeper, which was constructed from a No. 3 Outfit and the new Meccano X Series parts. The brush is made by threading Meccano Cord through holes in two Bush Wheels fastened one at each end of an Axle Rod. As in the prototype, the brush is rotated by friction from the running wheels. In the model the sweeper runs on four ¾" Flanged Wheels, and the brush axle is provided at each end with a Pulley fitted with a small Rubber Ring of the kind used on umbrellas.

Derrick Holloway won Third Prize with a model of a gas cooking stove, which is 18½" in length, 9½" in width and 12½" in height. There are two ovens fitted with shelves, plate racks, and warming shelves. A novel feature is the use of Hinges to represent the gas taps.

F. W. Hole also submitted a model of a cooker, but his model is of the electric type.

A. Leadbeater sent a model of a S.T.300 Radio Receiver, in which the tuning dials are represented by 3" Pulleys fitted with Meccano Dunlop Tyres. The model is very neatly built and has all the usual radio fittings. S. Wotherspoon sent several models, among which are an American rocking chair, an electric vacuum cleaner, and a bath complete with shower spraying apparatus.

Meccano Power Driven Models

Further Applications of Clockwork Motors

IN the previous article under this heading we dealt with the different types of Meccano Clockwork Motors and general hints on fitting them into models. Those boys who do not possess a power unit cannot appreciate to its full extent the pleasure derived from a model that actually works without being touched by hand. The greatest joy is experienced when, after a model has been built, it is set in motion by a touch of the control lever, a further movement of which will bring the model to a standstill again. The Clockwork Motors have innumerable applications, and they may be used in practically every case where a power unit is required.

The three models appearing on these pages show how the Motors may be arranged in small models. For each of these Pulleys and Cord are employed for driving purposes, and the different arrangements of guide Pulleys give a good idea of how belts may be used for connecting two Pulleys in almost any position. The chief essential in belt-driven models is to avoid large knots in the cord, and to lead it on to the Pulley in line as nearly as possible with the groove.

A rubber band can sometimes be used to advantage in place of cord, but this is only suitable for short belts. If cord will not grip the Pulleys, the trouble can be overcome by placing a small rubber band round the Pulley so that it fits closely in the groove. The cord, resting on this, is prevented from slipping.

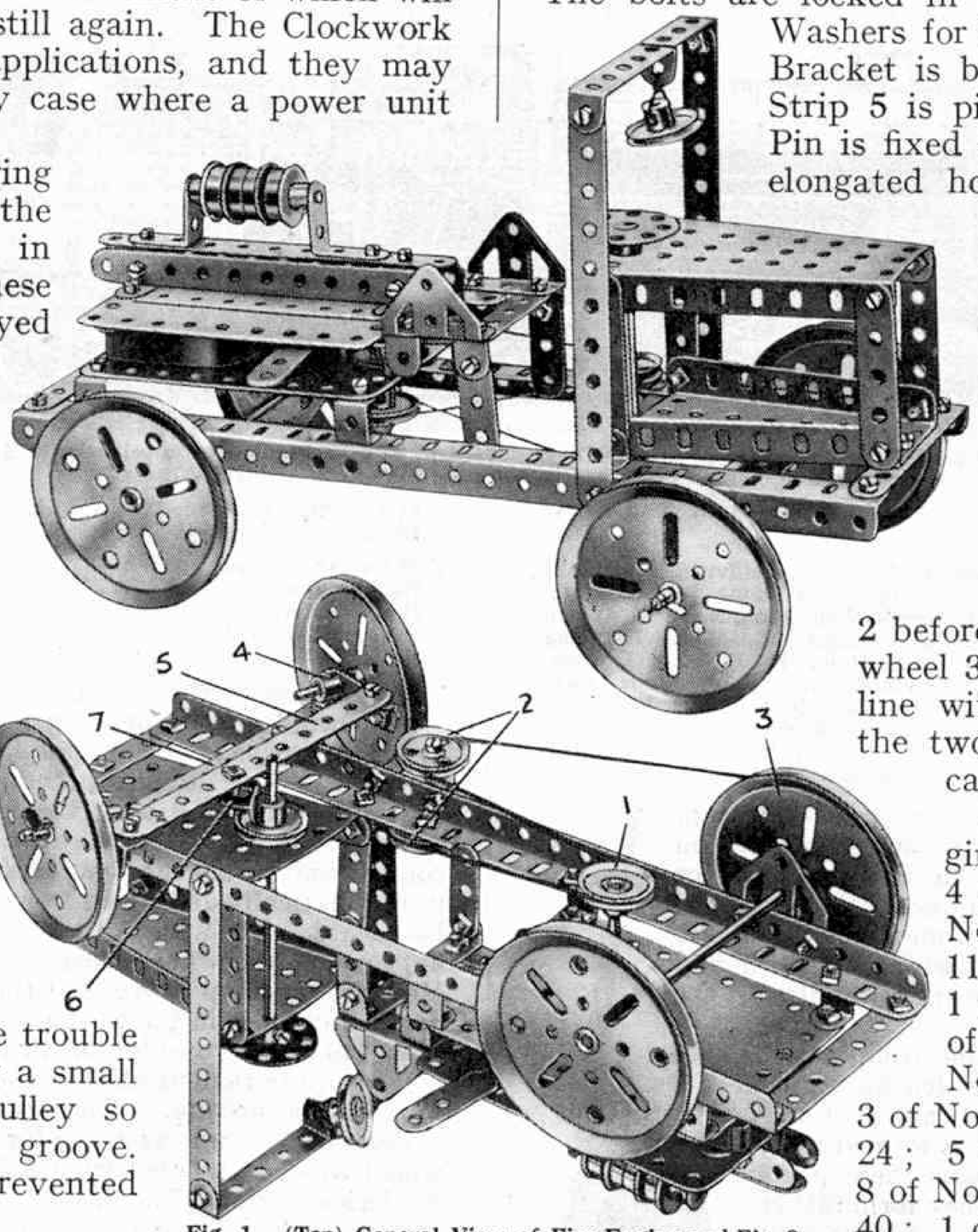


Fig. 1. (Top) General View of Fire Engine and Fig. 2, Underneath View.

A Realistic Model Fire Engine

The model Fire Engine shown in Fig. 1 can be built with the parts contained in a No. 2 Outfit, with the addition of a No. 2 or 1a Clockwork Motor. Fig. 2 is an underneath view of the model, which shows the arrangement of the drive and the steering mechanism.

The frame should be constructed first, by bolting $3\frac{1}{2}$" Strips between the ends of two $12\frac{1}{2}$" Angle Girders. A Sector Plate is bolted to the front Strip, and is held down in addition by two Angle Brackets bolted to the side girders. Four $2\frac{1}{2}$" Strips bolted vertically to the flanges of the Plate carry another similar Plate that forms the top of the bonnet. The Clockwork Motor is mounted on four Double Brackets, and two $5\frac{1}{2}$" Strips bolted to the Motor support the driver's seat, which is composed of $2\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strips and Trunnions. Three additional $5\frac{1}{2}$" Strips are fixed at one end to a Double Bent Strip and at the other end to two $\frac{1}{2}$" Reversed Angle Brackets, between which is fixed the dummy hose reel, made of four $\frac{3}{4}$" Flanged Wheels and a 2" Rod.

The front axle 7 is formed from two $5\frac{1}{2}$" Strips fixed to the side Girders by Angle Brackets. At each end of the front axle $\frac{3}{8}$" Bolts are passed through the holes and inserted in the tapped bores of Cranks 4 (Fig. 2). The bolts are locked in position by nuts, and carry Washers for spacing purposes. An Angle Bracket is bolted to each Crank and the Strip 5 is pivoted to each. A Threaded Pin is fixed to the Strip and engages the elongated hole in the Angle Bracket 6, which is attached to the boss of a 1" Pulley. The Pulley is carried on the lower end of the steering column.

A 1" Pulley 1 is carried on a 2" Rod that is inserted in place of the Motor driving spindle. A length of cord is passed round the Pulley, and then led round guide Pulleys 2 before passing round the rear road wheel 3. The Pulley 1 should be in line with a point midway between the two guide Pulleys 2, which are carried on $\frac{3}{8}$" Bolts.

Parts required for Fire Engine :—10 of No. 2 ; 2 of No. 3 ; 4 of No. 5 ; 2 of No. 6a ; 2 of No. 8 ; 1 of No. 10 ; 4 of No. 11 ; 8 of No. 12 ; 2 of No. 12a ; 1 of No. 15 ; 1 of No. 15a ; 2 of No. 17; 1 of No. 18a; 4 of No. 19b ; 4 of No. 20b ; 3 of No. 22 ; 2 of No. 22a ; 1 of No. 24 ; 5 of No. 35 ; 58 of No. 37 ; 8 of No. 37a ; 7 of No. 38 ; 1 of No. 40 ; 1 of No. 45 ; 1 of No. 48 ; 3 of No. 48a ; 2 of No. 54 ; 2 of No. 62 ; 4 of No. 111c ; 1 of No. 115 ; 2 of No. 125 ; 2 of No. 126 ; 2 of No. 126a ; 1 No. 2 Clockwork Motor.

Flying Machine

The fascinating model illustrated in Fig. 3 represents the popular fairground attraction in which the cars are suspended from long arms, and gradually fly outward as they pick up speed. The model is simple to construct and can easily be adapted for driving by hand if a Clockwork Motor is not available. Except for the Motor, the parts are contained in a No. 1 Outfit.

A $5\frac{1}{2}" \times 2\frac{1}{2}"$ Flanged Plate forms the base, and to this four $12\frac{1}{2}$" Strips are bolted and held together at their upper ends by three $2\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strips and a $2\frac{1}{2}$" Strip. A second $2\frac{1}{2}$" Strip carries a $\frac{1}{2}" \times \frac{1}{2}"$ Reversed Angle Bracket to form a bearing for a $3\frac{1}{2}$" Axle Rod.

The Rod carries a 3″ Pulley Wheel and a Bush Wheel to which four $5\frac{1}{2}$″ Strips are bolted. The cars are suspended by lengths of Cord from the outer ends of the Strips. Two of the cars are made from Sector Plates and Flat Trunnions, and the remaining two each consist of a $2\frac{1}{2}$″ Strip and Trunnion. Similar cars are placed opposite each other to maintain the balance of the model.

A landing platform is arranged slightly below the level of the cars. This is a $5\frac{1}{2}$″ Braced Girder attached by means of two $2\frac{1}{2}$″ Strips to a $2\frac{1}{2}$″ × $\frac{1}{2}$″ Double Angle Strip bolted between the two $12\frac{1}{2}$″ Strips. The Clockwork Motor is bolted in place to the side flange of the base plate, each securing bolt carrying a Washer for spacing purposes. The driving spindle of the Motor carries a 1″ Pulley Wheel, and Cord passed round this goes over two guide Pulleys before passing round the 3″ Pulley on the vertical Rod. The guide Pulleys are carried on a $3\frac{1}{2}$″ Axle Rod journalled in a $2\frac{1}{2}$″ × $\frac{1}{2}$″ Double Angle Strip, but one of them should be free on the Rod. Two Washers space each Pulley from the Double Angle Strip.

Parts required for Flying Machine :—4 of No. 1 ; 4 of No. 2 ; 6 of No. 5 ; 4 of No. 12 ; 2 of No. 16 ; 1 of No. 19b ; 3 of No. 22 ; 1 of No. 24 ; 1 of No. 35 ; 35 of No. 37 ; 6 of No. 38 ; 1 of No. 40 ; 4 of No. 48a ; 1 of No. 52 ; 2 of No. 54 ; 1 of No. 100 ; 1 of No. 125 ; 2 of No. 126 ; 2 of No. 126a ; 1 No. 2 Clockwork Motor.

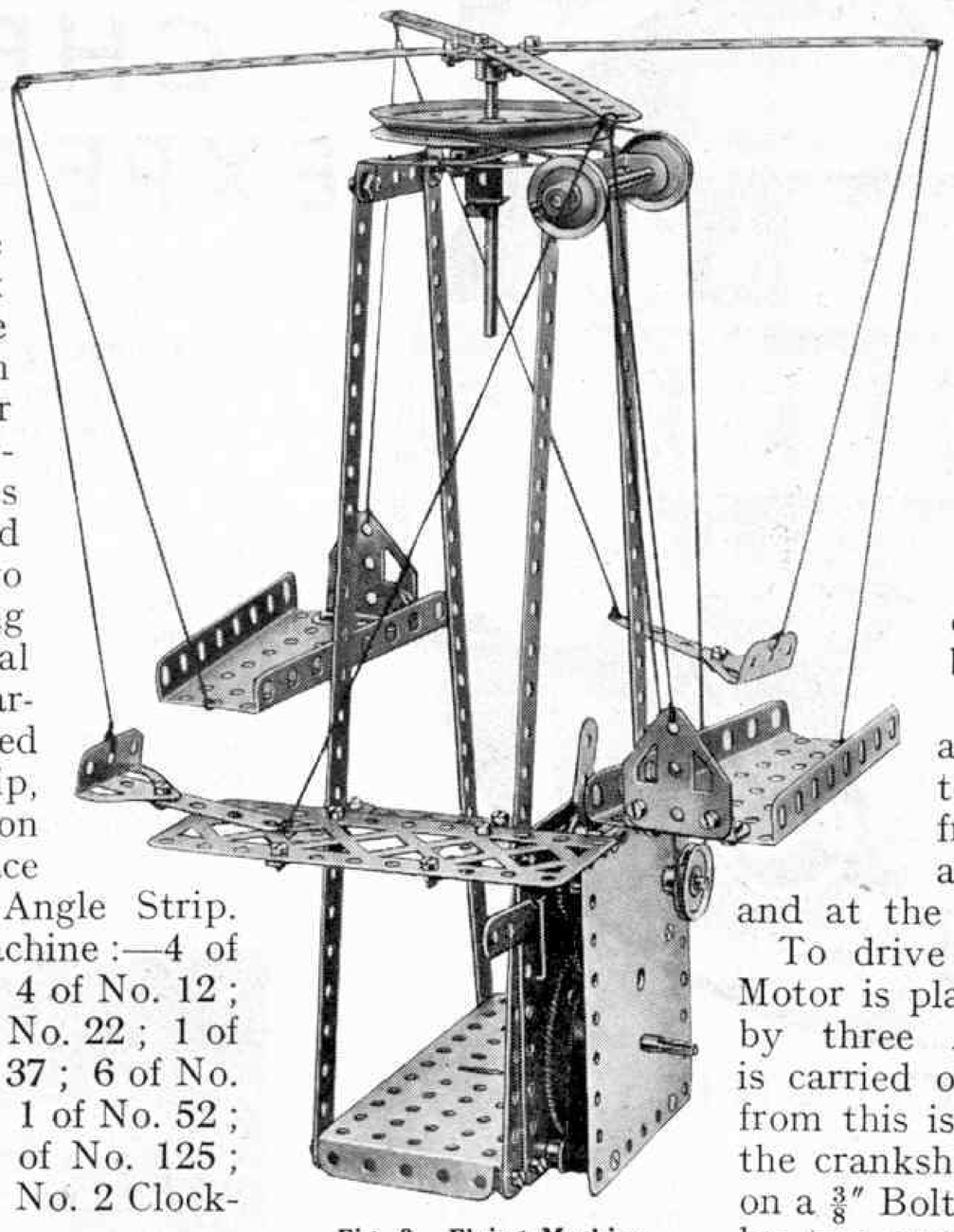


Fig. 3. Flying Machine.

Horizontal Steam Engine

The single-cylinder horizontal engine shown on this page gives a good idea of the general principles governing the operation of an actual engine of this type. Steam is first admitted at one end of the cylinder, and forces the piston to the other end, when the steam is cut off and allowed to enter the cylinder at the opposite end, thus forcing the piston back again. This reciprocating movement is converted to rotary motion by means of a crank and connecting rod. There are many different types of reciprocating engines, but all operate on a similar principle to this. It is interesting to note that, although vast strides have been made in improving the efficiency of the steam engine, the principles of operation are much the same now as they were after James Watt developed Newcomen's engine to a state of comparative perfection.

The Meccano model shown in Fig. 4 can be built with a No. 1 Outfit. The addition of the Clockwork Motor increases the fascination and interest of the model, which looks most realistic when operating under its own power like the actual engine.

The two sides of the base each consist of two $12\frac{1}{2}$″ Strips connected at their ends by $2\frac{1}{2}$″ Strips. A $5\frac{1}{2}$″ × $2\frac{1}{2}$″ Flanged Plate is fitted between the two sides, which are connected at the opposite end by two $2\frac{1}{2}$″ × $\frac{1}{2}$″ Double Angle Strips. One of the crankshaft bearings is formed from a Flat Trunnion and a $\frac{1}{2}$″ × $\frac{1}{2}$″ Reversed Angle Bracket, and the other from a Trunnion and Reversed Angle Bracket, the Trunnion being fixed to the $12\frac{1}{2}$″ Strips by Angle Brackets. The crankshaft is made up of two 2″ Axle Rods each carrying at its inner end a 3″ Pulley Wheel. A $1\frac{1}{2}$″ Axle Rod 2 is passed through these to form the crankpin, and is held in place by Spring Clips. The Rod 2 is passed through the end hole of a $5\frac{1}{2}$″ Strip, the other end of which is pivoted to an Angle Bracket clamped on the end of the piston rod by means of two Spring Clips.

The piston is represented by a 1″ Pulley Wheel and moves to and fro in a "cylinder" made from Double Angle Strips, bolted at one end to a Bush Wheel and at the other to a Flat Trunnion.

To drive the model a No. 2 Clockwork Motor is placed as shown and fixed in place by three Angle Brackets. A 1″ Pulley is carried on the driving spindle, and cord from this is led to one of the 3″ Pulleys on the crankshaft. A guide Pulley 1 is carried on a $\frac{3}{8}$″ Bolt that is fixed to an Angle Bracket by two nuts. The Angle Bracket is bolted to a similar part attached to the frame.

Parts required for Horizontal Steam Engine :—4 of No. 1 ; 1 of No. 2 ; 4 of No. 5 ; 8 of No. 12 ; 1 of No. 16 ; 2 of No. 17 ; 1 of No. 18a ; 2 of No. 19b ; 2 of No. 22 ; 1 of No. 23 ; 1 of No. 24 ; 8 of No. 35 ; 35 of No. 37 ; 3 of No. 37a ; 8 of No. 38 ; 1 of No. 40 ; 6 of No. 48a ; 1 of No. 52 ; 1 of No. 111c ; 2 of No. 125 ; 1 of No. 126 ; 2 of No. 126a ; 1 No. 2 Clockwork Motor.

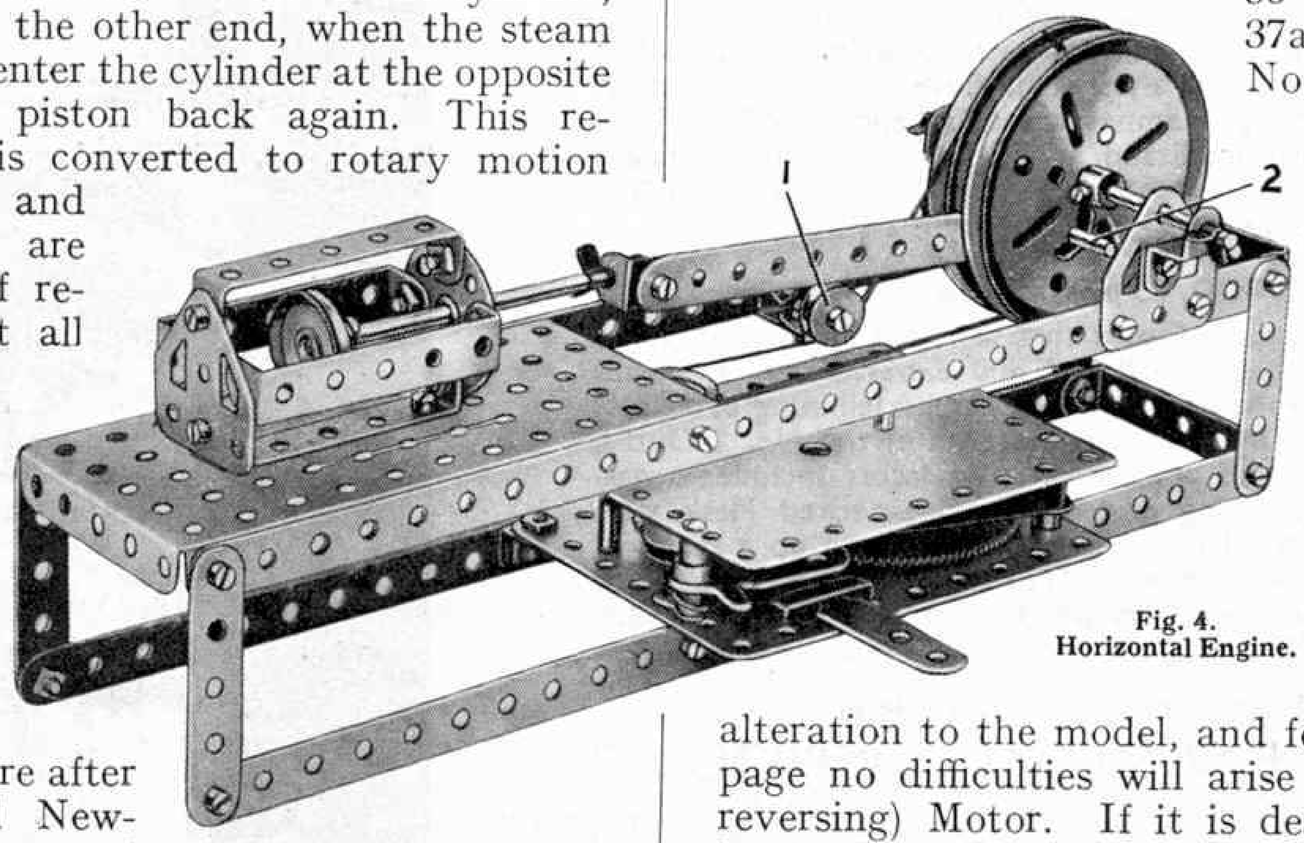


Fig. 4. Horizontal Engine.

The models described above are all fitted with a No. 2 Motor which is the largest and most powerful clockwork power unit. A No. 1a Motor can be fitted in each case without necessitating any alteration to the model, and for the two models on this page no difficulties will arise in fitting a No. 1 (non-reversing) Motor. If it is desired to fit a No. 1 unit in the Fire Engine in place of the larger Motor it will be necessary to extend one of the side plates at one side by means of Strips, so that it can be bolted down to the Double Brackets on the $12\frac{1}{2}$″ Angle Girders of the chassis. An extension of $\frac{1}{2}$″ only is necessary.

KEMEX

No. 1 KEMEX OUTFIT

130 Experiments

This Outfit contains a supply of specially selected chemicals, together with a length of Magnesium Ribbon, sufficient to perform 130 attractive and varied experiments. The apparatus provided in the Outfit includes Test Tubes and a Test Tube Holder, a Glass Funnel, Filter Papers, and Glass Delivery Tubes, with a simple and highly-efficient Spirit Lamp that makes the Outfit completely self-contained.

Price **7/6**

No. 2 KEMEX OUTFIT

250 Experiments

This Outfit includes the whole of the contents of the No. 1 Outfit, and further chemicals that increase the range of experiments up to 250. The additional apparatus includes a porcelain Evaporating Dish, Special Test Tubes to withstand high temperatures, a handsome Test Tube Stand, and the Kemex Retort Stand and Ring, with Wire Gauze.

Price **15/-**

No. 3 KEMEX OUTFIT

350-400 Experiments

This is a splendid complete Outfit that provides a boy with all he requires to carry out between 350 and 400 experiments, and thus enables him to acquire a sound knowledge of the fascinating principles of chemistry. The Outfit includes the contents of the No. 2 Outfit, with additional chemicals and apparatus. The latter includes a gas-generating apparatus, consisting of a large wide-necked Flask with Thistle Funnel and Delivery Tubes. These items open up a series of experiments of outstanding interest. There is also an extension for use on the Kemex Retort Stand, to which apparatus may be readily fitted on similar lines to those adopted by actual chemists. Price **25/-**

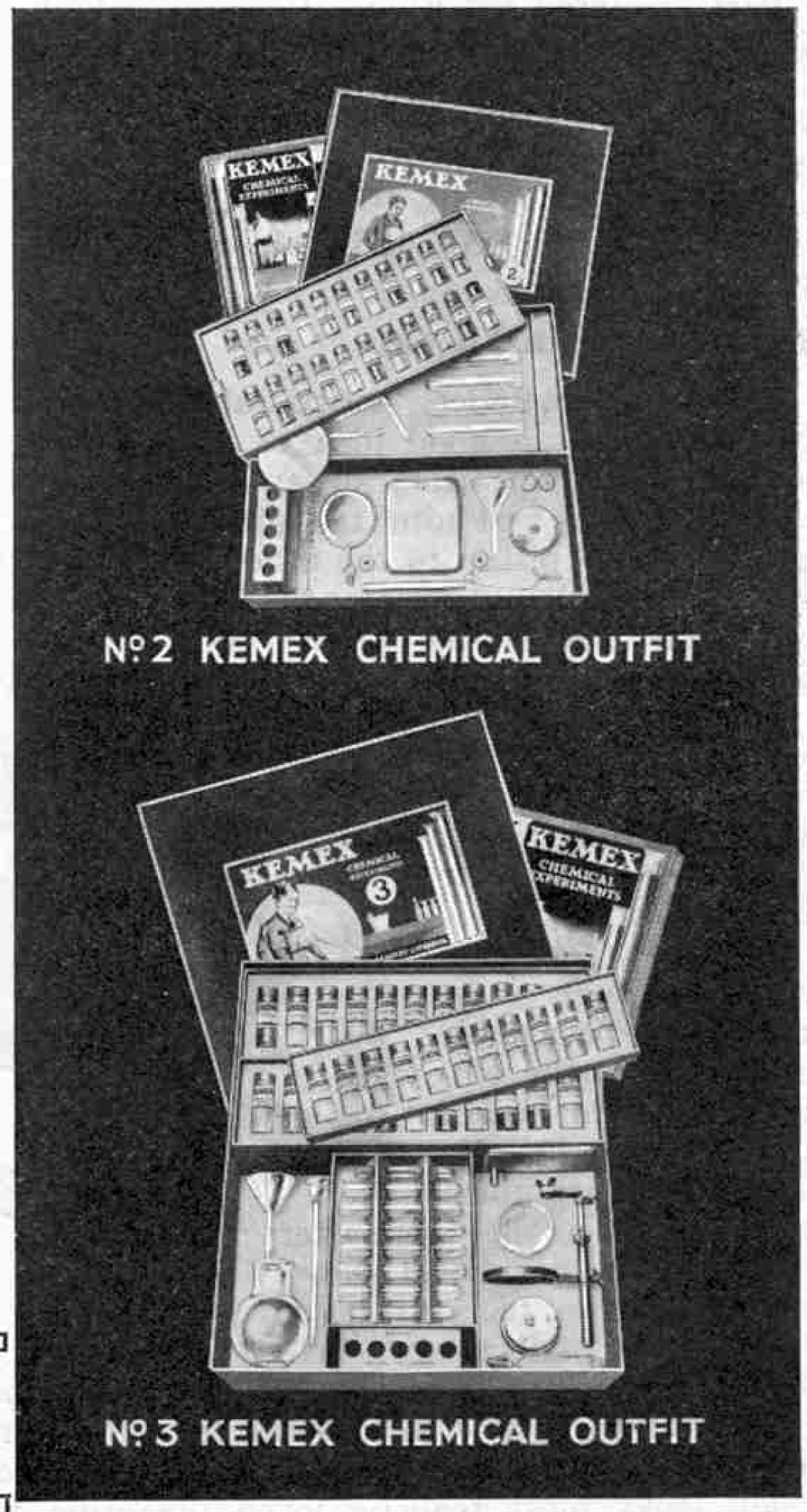
Kemex Chemical Outfits are manufactured by

MECCANO LTD., BINNS ROAD, LIVERPOOL 13

CHEMICAL EXPERIMENTS

The contents of the new Kemex Chemical Outfits will provide many hours of fascinating fun. With the apparatus and materials contained in them a boy can make dyes, inks and soaps ; test foodstuffs for impurities ; analyse air and water ; grow crystals ; write with electricity ; make invisible inks and a chemical garden ; prepare gases, and perform a host of other interesting chemical experiments.

The Outfits include everything necessary, and the hundreds of experiments that may be made are described in a simple manner in a well-illustrated Manual.



AUTOMATIC REVERSING GEAR

The attraction of a Meccano model that is used for display or demonstration purposes is increased considerably when some form of automatic action is incorporated. For instance, a model pithead gear fitted with cages that are alternately raised and lowered presents much more interest than a similar model in which no working mechanism is included. Similarly, a bascule bridge that can be made to rise and fall, is much more interesting than a stationary model.

In order to obtain a continuous action for models of this type, it is necessary to incorporate a Meccano Electric Motor, and some form of automatic reversing gear that will enable the direction of the transmission gearing to be reversed at the required times. Actually the simplest method is to use a "trip" gear connected to the reversing switch of the motor. This scheme is not suitable when the model is to be run for long periods, however, as the constant reversing of the armature has a detrimental effect on the motor itself. For the best results the armature shaft of the motor should turn constantly in one direction.

In the design of an automatic mechanical reversing gear the Meccano model-builder has considerable choice. He may, for instance, use a gear in which the "change-over" action is obtained by a reverse gear controlled by a spring plunger that in turn is actuated by the moving portion of the model. This type of reversing action is particularly suitable for models of transporter bridges, ship coalers, and similar mechanisms where a car or truck travels backward and forward on overhead rails. On reaching each end of the track the car presses against the spring plunger and brings the reverse gearing into action, which causes the car to travel back along the track until it automatically reverses itself again at the other end of the track.

Another method makes use of a screw-fed reversing drive; while yet another depends for its action on a cam driven at very slow speed.

A novel automatic reversing mechanism that is both compact and reliable can be built up by making use of the Meccano Single Throw Eccentric, part No. 170. The Eccentric is mounted on a shaft driven at very slow speed from a secondary Rod connected to the Electric Motor. A Strip is bolted to the arm of the Eccentric, and a Collar is pivotally secured to the outer end of the Strip by means of a Bolt and lock-nut. The Collar is mounted freely between two fixed Collars on a shaft that slides in its bearings. This shaft carries two Pinions, either of which may be engaged with a Contrate Wheel mounted on a Rod forming the final driven shaft.

The slow speed drive applied to the Eccentric causes the arm to be drawn backward and forward, and the sliding shaft is consequently moved in its bearings. The Pinions on the shaft thus engage the teeth of the Contrate Wheel alternately, and this action results in the final driven shaft being rotated first in a clockwise and then in an anti-clockwise direction. The speed of the drive operating the Eccentric can be altered by using different gear trains, and the period between the "change-over" can thus be controlled.

CYLINDER ASSEMBLY

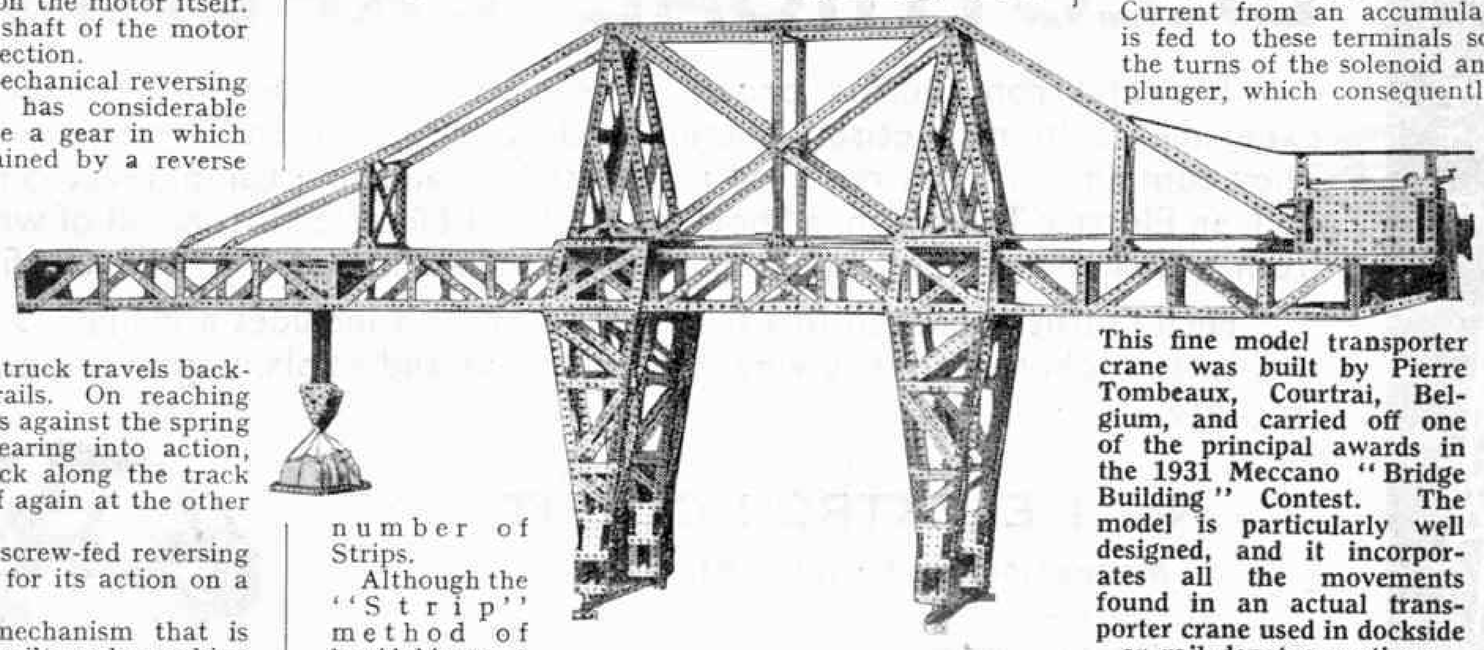
The Meccano system contains a wide range of parts that may be used in the building of cylinders, boilers and tubular elements of various diameters and lengths.

The best known cylindrical element is the Boiler (No. 162b). This consists of a continuous strip of metal rolled into cylindrical form, and it may be fitted with two Ends (No. 162a) to produce a complete Boiler unit 2" diam. and 4¾" long. In addition to its application as a steam Boiler in Meccano model steam plants, the part can be used also as a petrol tank or as a container for water or other liquids.

A novel application for the Boiler is in the assembly of a model "snow motor." The actual machine is fitted with two large drums that rest on the surface of the snow and support the frame and engine of the tractor. A strip of metal is secured spirally to the surface of each drum, and the drums themselves are mounted in bearings so that they may be rotated by means of the engine of the tractor. The drums thus form large "worms," and when rotated they draw the tractor over the surface of the snow by means of a wormthrust action.

A Meccano Boiler may be used for these drums with excellent effect, Curved Strips being bolted to the outside surface of each Boiler to form the spiral "threads" by means of which the model is propelled. The drums may be mounted in bearings in the frame of the tractor, and driven by an E1 or E6 Motor through sprocket gearing. A model built on these lines can be made to operate quite efficiently, and it will be capable of "screwing" its way through soft sand or other substances in which a model tractor fitted with normal road wheels would sink.

Where a large diameter Boiler is required, this may be built up by using Circular Plates, Hub Discs, etc., and a number of Strips. For instance, a Boiler 2½" in diameter may be assembled by securing Strips around a Face Plate (No. 109) by means of Angle Brackets. A larger Boiler results from the use of 3" Pulleys for the End Plates, while still larger cylindrical units may be built up by using the 4" and 6" Circular Plates and the 5½" Hub Discs, and a correspondingly larger number of Strips.



This fine model transporter crane was built by Pierre Tombeaux, Courtrai, Belgium, and carried off one of the principal awards in the 1931 Meccano "Bridge Building" Contest. The model is particularly well designed, and it incorporates all the movements found in an actual transporter crane used in dockside or rail depot operations.

Although the "Strip" method of building a cylinder produces quite a neat result, the best effect is obtained when plates are employed for the cylinder walls. The bending of Meccano Plates to produce a cylindrical shape is a difficult process, but readers should note that the Boiler may be used in this capacity, as it is made from springy metal and consequently can be opened out or compressed to give various diameters. For example, two Boilers opened out, and afterwards overlapped and bolted together, may be fitted round a 4" Circular Plate to produce a neat closed tank.

Another useful cylindrical part is the Sleeve Piece. The best known application for this part is as a steam engine cylinder, a ¾" Flanged Wheel being pushed over each end of the part to form cylinder caps. In addition to being used separately, several Sleeve Pieces may be employed together to form a pipe or other long tubular unit such as an ornamental column, an excellent instance of this being found in the large demonstration model of the Tower Bridge. When used in this way the Sleeve Pieces are held together by means of Chimney Adaptors, a Rod being passed through the centre of the complete unit to lock the separate Sleeve Pieces together rigidly.

AN INTERESTING ELECTRO-MAGNET

Many of our readers will be familiar with the assembly of an electro-magnet from Meccano Parts using a Meccano Bobbin, a quantity of 23 or 26 gauge S.C.C. wire, and a Meccano Pole Piece. This construction produces an efficient cored solenoid that may be used in Meccano relays and model electro-mechanical movements of all kinds. The magnet produced in this way is 1¾" overall, the Pole Piece being this length, and the Bobbin portion 1" long. In small models it is sometimes difficult to incorporate a magnet of this size, and readers therefore will be interested in the details of an electro-magnet made from standard parts, but measuring only ¾" overall.

The core-piece of this neat little magnet is the plunger from a Meccano Spring Buffer (No. 120a). The bobbin on which the wire is wound is built up round the shank of the Buffer plunger. The circular fibre coil cheeks are first removed from the brass centre tube of a Meccano Bobbin (No. 301), and one cheek is pushed on to the shank of the Buffer so that it is as close to the buffer head as possible. A strip of stiff brown paper ⅜" wide is now bound round the plain portion of the buffer plunger, a touch of Seccotine being applied to the end of the strip of paper to hold it in position. The strip of paper serves to secure the fibre cheek against the head of the plunger, and it also provides suitable spacing between the two fibre pieces forming the bobbin ends.

The second circular fibre cheek is now placed on the shank of the Buffer, and a nut is screwed on to the threaded end of the Buffer to hold the fibre cheek in place. The result of this assembly is a small insulated bobbin built of fibre and paper that fits round the steel core formed by the Buffer plunger. The bobbin may be wound with Meccano 26 gauge S.C.C. wire, or a finer gauge may be employed so that a greater number of turns may be included on the bobbin. The ends of the wire should be passed through the holes in the end cheeks and anchored to terminals insulated from the frame of the model. Current from an accumulator or mains transformer is fed to these terminals so that it may pass round the turns of the solenoid and thus energise the Buffer plunger, which consequently becomes a magnet.

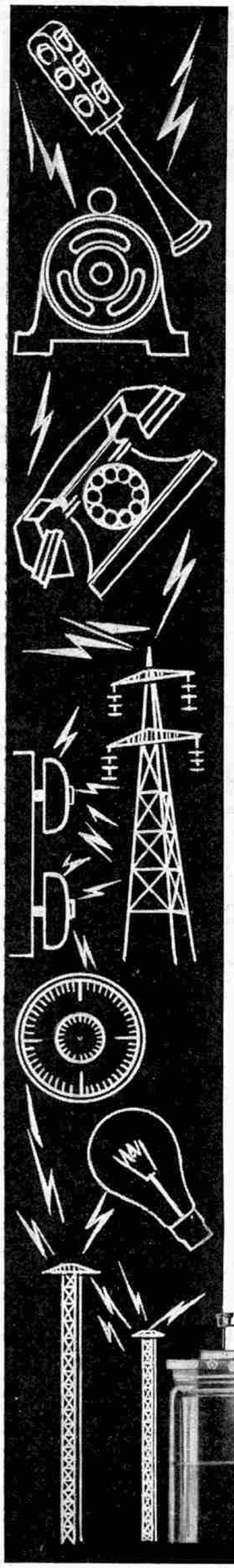
WING NUT

The range of Meccano parts contains examples of many actual engineering fittings, and where an actual unit is not included it may be built up from two or more of the existing parts. For example, a wing nut is not included in the standard Meccano range but it is possible to assemble several interesting wing nuts from standard parts. A useful pattern that can be employed in connection with screw adjustment gears is formed from a Threaded Boss fitted with two Threaded Pins. The screwed shanks of the Pins are threaded into the grub-screw bores of the Boss, so that the plain portions project and may be gripped by the fingers. A larger pattern of "wing" or "butterfly" nut is assembled from a Strip Coupling and a 1" Corner Bracket (No. 133a). The Corner Bracket is slipped into the slotted portion of the Coupling and grub-screws are then driven into the threaded bores of the Coupling so as to grip the Corner Bracket rigidly. The arms of the Bracket give the required wing or butterfly shape to the end of the nut. The plain end of the Strip Coupling may be secured on either a threaded or plain Rod by means of a grub-screw, and the complete unit will be found to give a very neat effect. A simpler type of nut that will serve its purpose quite efficiently may be formed by passing a 1" Axle Rod through the plain bore of a Collar and locking it in place by means of a grub-screw, the other grub-screw hole being used for mounting the nut on a Screwed Rod, etc. A Threaded Boss fitted with two ⅜" bolts (held in place by lock nuts) also forms a useful wing nut for Meccano mechanisms.

ADDITIONAL FUSELAGE SECTIONS. We were interested in your proposal that additional fuselage underside sections should be added to the range of Meccano Aeroplane Parts, and we agree that these additions would increase the realism of the models when viewed from below.

These sections would of course add to the expense of the complete model, but we hope to be able to produce something on these lines in the future. For the present we suggest that you cut the required sections from stout cardboard and push them into position between the sides of the fuselage. The cardboard sections can be treated with aluminium paint so as to produce a uniform result. *(Reply to D. A. Mostyn, Acton, W.3.)*

SPOTLIGHT.—A miniature spotlight for the Meccano No. 2 Motor Car would form a novel addition. We shall consider this, and in the meantime we would remind you that an Electric Lighting Set for the Car is now available. *(Reply to G. Key, Stone.)*



ELEKTRON

ELECTRICAL EXPERIMENTS

The Elektron Outfits provide the necessary material for a progressive series of experiments in magnetism, frictional electricity, current electricity and electroplating. They contain the parts required to construct a Reading Lamp, Electro-magnets, an Electric Bell, an Electric Telegraph, a Shocking Coil and Electric Motors, all of which may be worked from a Bichromate Cell built up from materials included in the Outfit.

Each Outfit is packed in a handsome box, and includes a Manual, splendidly illustrated with actual photographs, giving full directions and explaining every experiment in simple language.

No. 1 ELEKTRON OUTFIT

Magnetism and Static Electricity

The No. 1 Outfit contains two powerful Bar Magnets and a reliable Magnetic Compass, together with everything necessary for the carrying out of a series of fascinating magnetic experiments. In addition there are materials for experiments in frictional or static electricity, and for the construction of an Electric Compass and two forms of Electroscope. There are also parts for constructing a splendid portable Reading Lamp. Price **9/-**

No. 2 ELEKTRON OUTFIT

Magnetism, Static and Current Electricity

The No. 2 Elektron Outfit contains all that is included in the No. 1 Elektron Outfit, with additional parts that enable a splendid series of experiments in current electricity to be performed. Among these parts are a Horseshoe Magnet, and Coils and Yokes for the construction of Electro-Magnets that may be used in building a real Electric Bell, and a Buzzer for use in an electric telegraph system. A specially-wound coil and other necessary parts are supplied for assembling into a splendid Shocking Coil that will give hours of fun and excitement; and from other components two different working Electric Motors may be built. Electroplating is among the other fascinating experiments that can be performed with this Outfit. Price **25/-**

An Accessory Outfit is also available that converts a No. 1 Electron Outfit into a No. 2. Price **16/-**

Manufactured by MECCANO LIMITED, BINNS ROAD, LIVERPOOL 13

"Simplicity" Model-Building Competition

The Most Popular of all Meccano Contests

Each of the "Simplicity" competitions that have been organised in the past has been a great success, and we are constantly receiving requests from model-builders all over the world asking us to organise further competitions of this kind. We are therefore arranging another "Simplicity" Contest this month. The secret of the popularity of these competitions lies in the fact that owners of even the smallest Outfits have as good a chance as the owner of a No. 7 Outfit of winning the First Prize.

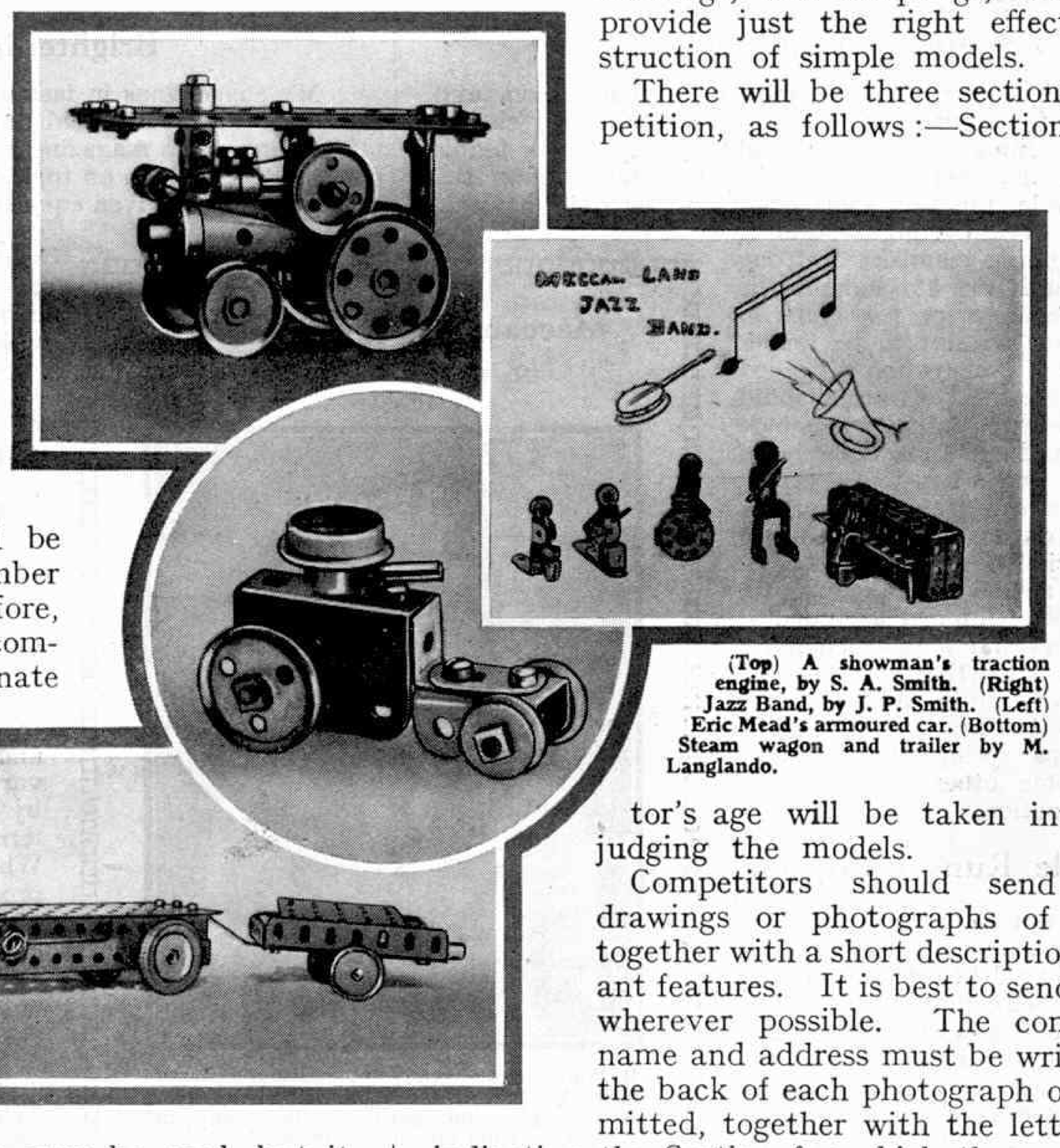
For the benefit of boys who did not enter the previous contests, and who are not familiar with the conditions under which a model may be entered, we again give full details of the kind of models that are most suitable.

"Simplicity" Contests differ from ordinary model-building contests in that models should be built from the least possible number of parts. It will be seen, therefore, that owners of small Outfits can compete on equal terms with fortunate possessors of large Outfits. It must not be thought, however, that competitors are restricted to any specified number of parts. This is not the case. Any number of parts may be used, but it should be clearly understood that the prizes will be awarded to those boys who succeed in building *the best models from the smallest possible number of parts*. This does not mean that the competitor who submits the smallest model will necessarily obtain First Prize. The model must also be realistic and well constructed.

The various models shown on this page won prizes in previous "Simplicity" Contests, and indicate better than words can do the kind of models that will win the prizes in the present Contest. These models must not be copied, however, and each competitor must construct his model entirely from his own ideas. There are thousands of subjects to choose from, and any kind of model may be submitted, so that the task of finding something suitable should not be difficult.

Although the Contest affords a splendid opportunity to the owner of a small Outfit, there is plenty of scope for the constructor who has at his disposal the more advanced parts, such as Cranks, Gear Wheels, Swivel Bearings, and Couplings, etc., which often provide just the right effect in the construction of simple models.

There will be three sections in the Competition, as follows:—Section A, for competitors over 14 years living in the British Isles; Section B, for competitors under 14 years living in the British Isles; Section C, for competitors of all ages living Overseas. Each competitor's age will be taken into account in judging the models.



(Top) A showman's traction engine, by S. A. Smith. (Right) Jazz Band, by J. P. Smith. (Left) Eric Mead's armoured car. (Bottom) Steam wagon and trailer by M. Langlando.

Competitors should send either good drawings or photographs of their models, together with a short description of all important features. It is best to send a photograph wherever possible. The competitor's age, name and address must be written clearly on the back of each photograph or drawing submitted, together with the letter A, B, or C, indicating the Section for which the model is eligible. No entry forms are needed, and there are no fees to be paid. *Actual models must not be sent.* A detailed list of the prizes to be awarded in each Section appears in the panel on this page.

Envelopes containing entries should be addressed:—May "Simplicity" Model-building Contest, Meccano Ltd., Binns Road, Liverpool 13.

It should be noted that photographs of prize-winning models become the property of Meccano Ltd., but unsuccessful entries will be returned to the senders provided that a stamped addressed envelope of the necessary size is enclosed with the entry. Sections A and B close for entries on 30th June, 1933; Section C will remain open until 31st August, 1933.

May "Simplicity" Model-Building Contest

The prizes in Sections A and C are:—
First Prize, Cheque for £3-3s.
Second Prize, Meccano Goods value £2-2s.
Third Prize, Meccano Goods value £1-1s.
Ten Prizes of goods value 5/–.
Ten Prizes of "Famous Trains," by C. J. Allen.

The Prizes in Section B are:—
First Prize, Cheque for £2-2s.
Second Prize, Meccano Goods value £1-1s.
Third Prize, Meccano Goods value 10/6.
Ten Prizes of goods value 5/–.

Summer Activities

This month clubs enter on a specially enjoyable season, and no opportunity of taking part in outdoor recreations should be missed. The evenings are long and light, and cricket or tennis matches may be arranged, while the greatest fun follows the organisation of cycle runs and short excursions on foot.

The formation of a cycling section is a sure means of giving members a strong interest in club activities throughout the summer, for there are very few clubs in which keen cyclists are not to be found. A certain amount of preparation is needed in order to make the most of this splendid recreation, for it is essential that members of a cycling section should know beforehand what is arranged and what to expect in connection with each run. A certain proportion of the outings may be pleasure trips carried out in the picnic spirit. In other cases care should be taken to fix some place of special interest as the destination, for members like to have a definite object, and in all clubs the most popular runs invariably are those arranged for such purposes as visiting aerodromes or works, or perhaps seeing the "*Flying Scotsman*" or some other famous train passing a busy junction.

Making Cycle Runs Enjoyable

It is important not to exhaust members by arranging runs that are too ambitious, and ample time should be left in which to enjoy rests in interesting places. The earlier runs also should be shorter and less arduous than those arranged towards the end of the summer session. A further point of importance is that the welfare of the younger members should be specially considered. They should be well looked after by the more responsible members of the party, and the length of run should be adjusted to suit their capabilities, even if this means providing a longer alternative route for the senior members of the section.

Finally funds must be considered in organising a cycling section, for incidental expenses are sure to arise. Little difficulty will be encountered in this respect if the familiar plan of making small weekly subscriptions is adopted. In most cases the money raised in this manner enables provision to be made for effecting necessary minor repairs during runs. Thus the subscription acts as a kind of insurance premium, and any funds remaining at the end of the session may be devoted to a special treat of some kind during the last excursion.

Whatever form summer activities may take, no opportunity of obtaining good photographs should be lost, for a particularly enjoyable ramble or cycle run is best recalled by this means. There is usually at least one member of a club who is a camera enthusiast, and a semi-official appointment as club photographer would encourage him to make a permanent record of club activities, especially during the summer season. He need not be out of pocket as a result of his efforts, for he could recover his outlay by making a small charge for prints.

Meccano Club Secretaries

No. 26. R. Woollcott

R. Woollcott is secretary of St. Saviour's (Raynes Park) M.C., which was affiliated in May, 1932. He has filled this position with energy and enthusiasm since the club commenced activities. Members specialise in the construction of large models of original design.

Brightening Club Magazines

My suggestions in last month's issue in regard to the contents of club magazines dealt with the more serious side of such productions. If a magazine is to be a success it is essential to include attractive articles on topics of interest to members, but the lighter side should be given equally careful attention, for the effectiveness of each issue largely depends on the variety of the fare provided, and notes on sport, jokes, competitions and similar contributions provide a complete and welcome change.

Such features as competition sections and brief paragraphs of general interest may be given special corners in a club magazine, but jokes and short humorous stories may either be concentrated on a single page, or scattered throughout the magazine to fill spaces that occasionally occur at the ends of articles, for as far as possible every article should commence at the head of a page.

Illustrations may be effectively employed to lighten a club magazine. There is little difficulty in reproducing drawings by the methods dealt with last month, and copies of magazines that reach me from various quarters show that this is realised by several enterprising editors. An interesting example is the magazine of the Whitgift School M.C. This is attractively produced, with a cover of tinted paper on which appears an illustration of the school, and includes many excellent drawings and well-designed pictorial headings that greatly improve the general appearance of the pages of each issue.

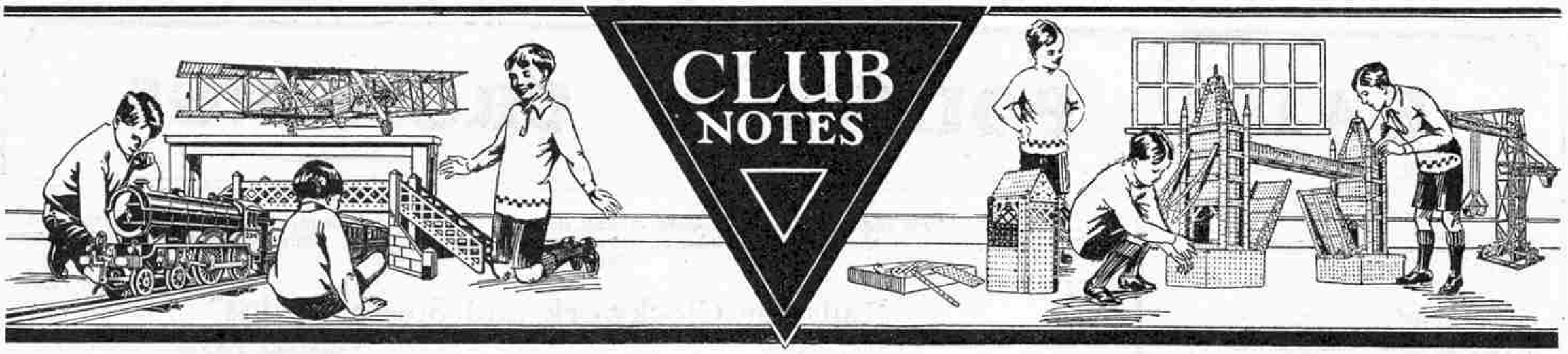
The club magazine that is most ambitious in regard to illustrations is "*The White Triangle*," of the Exeter M.C. This club appears to be rich in youthful cartoonists, and I look forward with interest to the humorous drawings, poking good-humoured fun at officials and members, that form a regular feature of each issue. Undoubtedly these add greatly to the fun and enjoyment of club life in Exeter.

Attractive Exhibition in London

The Fourteenth Annual Exhibition of the Holy Trinity (Barnsbury) M.C. will be held on Friday and Saturday, 12th and 13th May, 1933, at the Holy Trinity Parish Hall, Richmond Road, Barnsbury, N.1. The Exhibition will be opened at 5.30 p.m. on the first day and 2 p.m. on the second day, and the charge for admission is 6d., those under 14 years of age being admitted at half price. A cordial welcome will be given to all interested in Meccano and Hornby Trains, and a special invitation is extended to officials and members of other Meccano clubs.

Proposed Clubs

DAWLISH—P. Daniell, Cleveland House School.
GUERNSEY—C. Travers, Prince of Wales Hotel, Smith Street.
LIVERPOOL—James Bell, 100, Thornton Road, Bootle.
PORT TALBOT—E. Treharne, 9, Edward Street.
S. RHODESIA—Mr. G. L. Harrington, P.O. Box 39, Umtali.



Holy Trinity (Barnsbury) M.C.—A very successful winter session ended with active preparations for the club's forthcoming Exhibition. Special Model-building Evenings were devoted to the construction of Bridges and Tractors, and Mr. Stuart Wilson, Leader of the club, gave talks on "*How to Use Meccano Parts*" and on various types of Bridges. Other short Lectures have included one on "*Fireworks*," also by the Leader, and on "*Bees*," "*Coke*" and other subjects by members. Interesting Competitions have included a Memory Test, in which entrants were given two minutes to memorise the contents of a tray filled with Meccano parts. *Leader:* Mr. S. H. Wilson, 29, Thornhill Road, Barnsbury, N.1.

Beckenham M.C.—At one meeting, Mr. D. Ross, Leader of the club, gave an attractive demonstration of the capabilities of a Weston Photo-electric Cell. Model-building Evenings have included one in which members constructed models of Ships and Docks. An interesting Lantern Leoture on "*Soap Making*" has been given. Mr. D. Tiney, secretary of the club for the last few months, has been compelled to resign owing to leaving the district. The club united with the Croydon High School and South Croydon and Purley Clubs in a successful Exhibition. Club roll: 25. *Secretary:* R. S. FitzPatrick, 17, Blakeney Road, Kent.

Harlesden Methodist M.C.—Model-building Evenings alternate with Hornby Train Nights. Models constructed have included an A.E.C. Motor Chassis with a particularly efficient back axle, and a Railway Bridge for use on the Hornby Train Layout. Mr. G. Weightman, Leader of the club, gave an interesting talk on the correct use of Meccano parts and the handling of Hornby Train material, in preparation for the forthcoming Exhibition. A Lantern Lecture on "*The Transport of Cocoa*" was given, slides being kindly loaned by Cadbury Bros. Ltd. Club roll: 20. *Secretary:* J. Ford, 139, Wakeman Road, Kensal Rise, London.

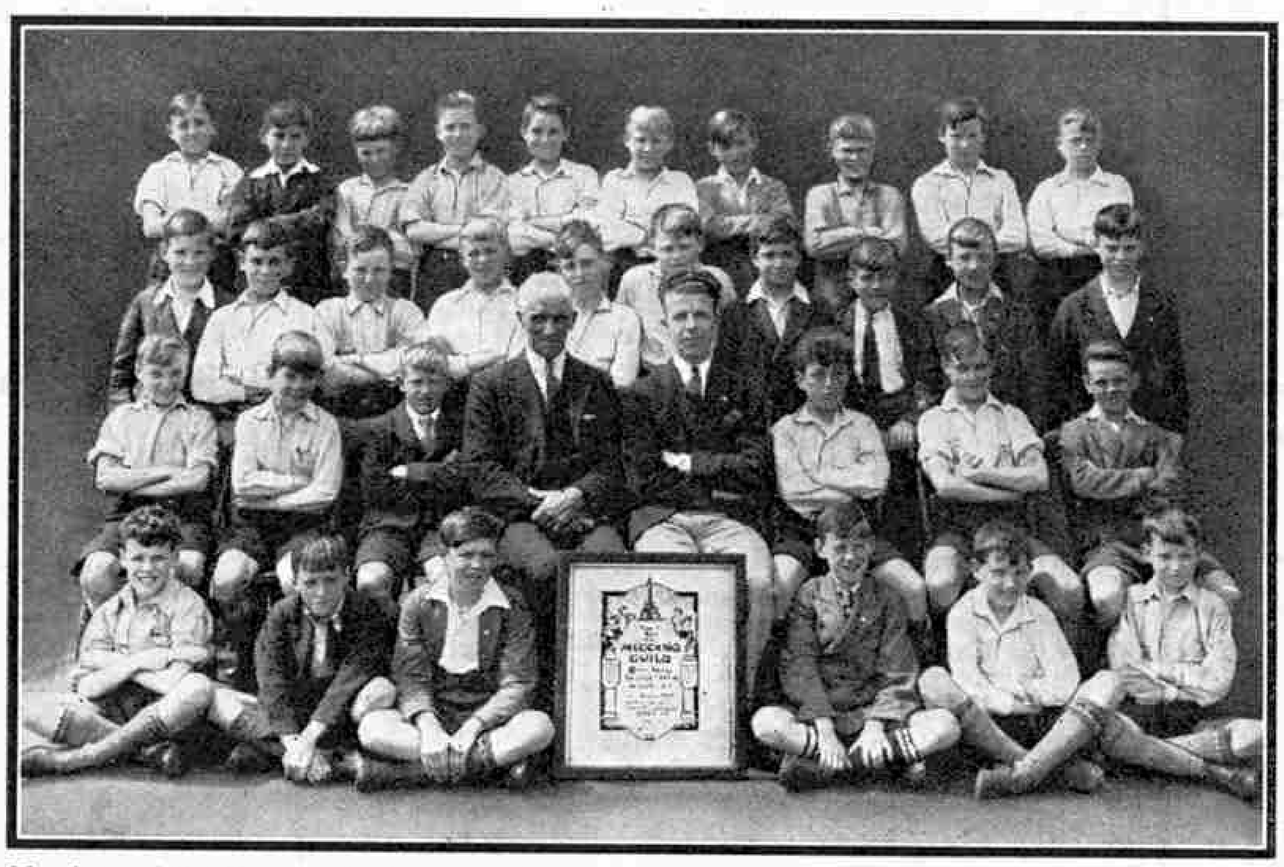
South Croydon and Purley M.C.—The chief event has been a great Exhibition organised in conjunction with the Beckenham and Croydon High School Meccano Clubs. This attracted a total of 807 enthusiastic visitors. Models entered in special Contests were on view, and other attractions included a Hornby Train Layout, referred to in the local press as realistic and thrilling in operation, and a Cinematograph Entertainment that attracted 385 spectators. The net proceeds were about £6, and half of this is being devoted to charitable objects. In the Model-building Contest there was a great struggle for the chief prize between a model of the G.W.R. locomotive "*King George I*'," built by D. Young, and J. J. Vertue's model of the Eiffel Tower, the former being the final selection of the judges. *Secretary:* J. Harris, Rossleigh, 76, Mayfield Road, Sanderstead.

Kendal M.C.—A successful Mock Trial has been held. The accused was found "Not Guilty" of murder, and events at the trial led to the discovery of the real culprit. In an Air Gun Competition those who secured the highest marks were excused subscriptions for a week. The Cycling Section has begun operations, the snowy conditions during their first run adding to the enjoyment of members rather than otherwise. Arrangements for a Summer Camp are already being made, and a successful Summer Session is anticipated. Club roll: 22. *Secretary:* L. Haslam, Middleton, Kirkby Lonsdale, Carnforth.

King's Lynn M.C.—The recent Exhibition was opened by the Mayor and was greatly enjoyed by the many visitors. The attractions included a display of models, including one of the King's Lynn Dock Lock Gates, an Electric Hornby Train Layout, and Gymnastic Displays. The Table Tennis room was open to visitors, and an Amplifier provided music in all the rooms. The Exhibition was held in the house of Mr. I. J. Thatcher, President of the club, to whom members are greatly indebted for many kindnesses. *Secretary:* A. S. W. Horn, Stanton House, The Chase, King's Lynn.

Mall School M.C.—Motor Racing Nights are a great attraction to members, and exciting races are arranged between Meccano models of motor vehicles and those built from Meccano Motor Car Constructor parts. Cinematograph Nights and Games Nights also are popular, parents and friends of members being invited to film exhibitions. K. Harrison, secretary of the club for two years, is no longer able to carry on with this work, and has been presented with a Wallet, Fountain Pen and Pencil in recognition of his great services. Club roll: 39. *Secretary:* M. L. Patterson, 8, Walpole Gardens, Twickenham.

Mallow M.C.—Members have united to build a splendid model of a Picture House. Curtains in front of the screen are rolled back automatically by a device secreted in one of the pillars of the model, and a special operating room has been built in which to install the club's projector. Inside this is a switchboard by means of which the operator can control the curtains and footlights. The Library has been enlarged and the demand for books is increasing. Club roll: 12. *Secretary:* W. J. Roche, 8, Spa Walk, Mallow, Co. Cork.



Members of the New Bradwell Boys' School M.C. with Mr. J. C. Harding, Leader, in the centre of the group. The club was affiliated in March, 1932, and its activities include Model-building and Hornby Train operation, in addition to Games. Football is the chief outdoor pursuit, and the club team has performed creditably during its first season.

Middlesbrough M.C.—In an "Aeroplane Contest," Meccano models and others built from Meccano Aeroplane Constructor Outfits were submitted, prizes being given in each section. A Debate has been held on the resolution "*That Bicycles Should be Taxed.*" As most of the members are cyclists, the proposer of the motion experienced a rough time! A Blow Football Match between officials and members ended in no scoring, although at the end the players were completely out of breath owing to their exertions. Other events have included Table Tennis Championships, a Story Night, a very enjoyable Club Party, and a Surprise Night, on which impromptu Talks were given. Club roll: 36. *Secretary:* R. E. Rowlatt, 3, Blenheim Villas, Longlands Road, Middlesbrough.

New Bradwell M.C.—The Football Club has had an excellent season, members showing great spirit and determination in the face of a series of unfortunate defeats. A Ping Pong Table has been constructed by two members, and a Bagatelle Table is now being made. A permanent Hornby Train Layout is being prepared and plans are being formed for an outdoor layout for the summer months. Club roll: 42. *Secretary:* R. Bellchambers, 29, King Edward Street, New Bradwell, Bletchley.

Stamford Hill M.C.—Model-building has been the chief activity of members, a large club model of a Funicular Railway arousing interest and enthusiasm. A keenly-fought Model-building Contest between the "Nuts" and the "Spanners" ended in a tie. The "Nuts" won the Table Tennis Championship. The club's Hornby Train Layout has been enlarged, and more rolling stock obtained in order to make operations more extensive and realistic. Club roll: 40. *Secretary:* D. Weitzman, 83A, Stamford Hill, London, N.16.

Braintree County High School M.C.—The chief features of a recent successful Exhibition were a Dockyard scene, a Farmyard and a Builder's Yard, each with appropriate models and scenic accessories. A Hornby Train layout also was on view and plays were presented in the evening, when prizes were distributed by Mrs. E. Rogers, wife of the Very Reverend E. Rogers, Dean of Bocking. Club roll: 24. *Secretary:* M. K. Miles, 1, Wordsworth Road, Bocking, Braintree.

Greenock Academy M.C.—A very successful Annual Exhibition was held, the "*Greenock Telegraph*" describing this as "greater than ever." The most attractive items were a Hornby Railway Layout, and the Grandfather Clock and a model Dock also aroused interest. An Aerodrome with nine aeroplanes of different types and a Motor Car Stand with seven model Motor Cars, were other features. Club roll: 74. *Secretary:* D. M. R. Steel, 25, Margaret Street, Greenock.

St. Peter's (Wolverhampton) M.C.—To the great regret of members, the Leader, the Rev. J. Du B. Lance, has resigned, but a cordial welcome has been given to his successor, the Rev. J. H. K. Dagger. Meetings continue to be devoted to Model-building and to operations on the club's Hornby Train Layout. Visits have been paid to a large Bakery and to the G.W.R. Station at Wolverhampton. Wireless is being introduced as an additional hobby. Club roll: 14. *Secretary:* V. Biddulph, c/o Westminster Bank, Lichfield Street, Wolverhampton.

AUSTRALIA

Kookaburra M.C.—Most meetings continue to be devoted to Model-building, proceedings being varied by a series of talks on "*Lives of Famous Engineers.*" A Concert also has been organised. The programme was contributed by members and included a rendering of a Club Song. Club roll: 10. *Secretary:* R. Culley, 8, Eastwood Terrace, Eastwood, South Australia.

Sydney M.C.—The Meccano Club and the Sydney Branch of the H.R.C. make use of the same club room and Library, and Visits and Exhibitions are arranged jointly. Members may belong to one or both of the two organisations. An interesting feature of Model-building activities is the demonstration of Super models by Mr. A. Lord, President of the club, and other meetings have included Social Evenings, Cricket Matches, and a visit of a party from Trinity Grammar School, which led to an interesting discussion. Club roll: 32. *Secretary:* W. J. T. Watson, 595, Parramatta Road, Leichhardt, N.S.W.

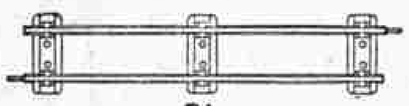
DENMARK

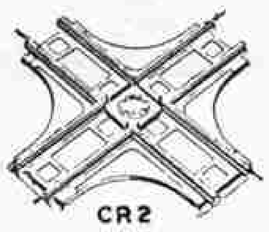
Copenhagen M.C.—The club's Christmas Party was very enjoyable and demonstrations of Meccano Electric Locomotives and other models added to the interest. Model-building Contests are held regularly. In one of these the use of only 25 Meccano parts was allowed, and in others aeroplanes built from Meccano and Aeroplane Constructor parts were submitted by competitors. Members are in correspondence with enthusiasts in Norway, Ireland, New Zealand and other countries, and the letters exchanged are read at meetings. Special events have included the club's Second Birthday Party and the Fourth Exhibition, at which 40 models attracted the interested attention of about 350 visitors. Club roll: 22. *Secretary:* F. Severin, Rud. Berghsgade 17, Copenhagen.

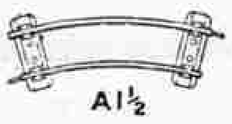
NORWAY

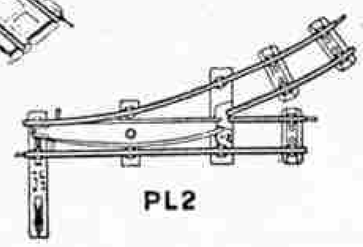
Sandefjord M.C.—Recent Model-building Evenings have been devoted to the construction of Bridges, the secretary of the club explaining the principles of each type built. Three meetings were made specially interesting by visits from Mr. J. Andersen, of the Oslo Philatelists Club. Mr. Andersen explained how stamps are made, described recent stamp productions and showed how counterfeit stamps may be detected. Club roll: 6. *Secretary:* T. Jacobsen, Box 38, Sandefjord, Norway.

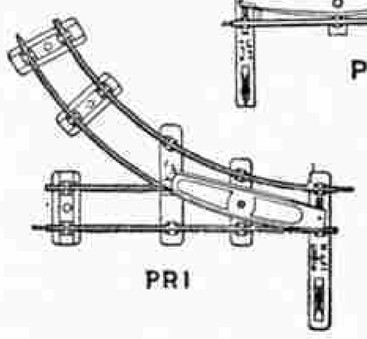
RAILS, POINTS & CROSSINGS

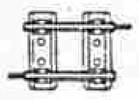


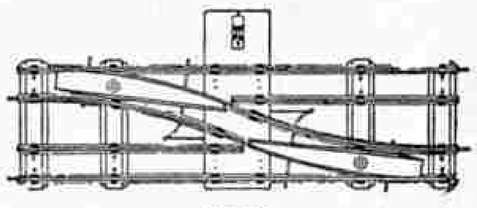


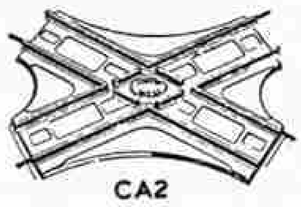


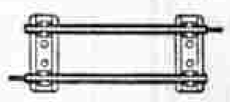


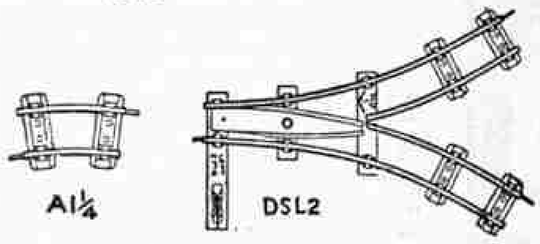


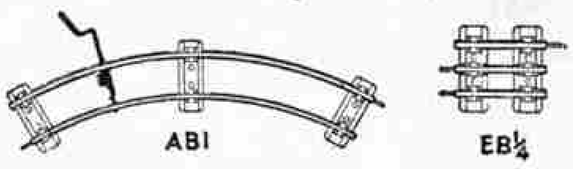


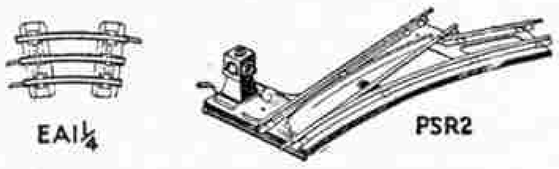


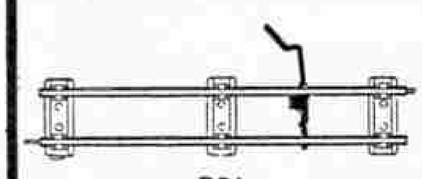


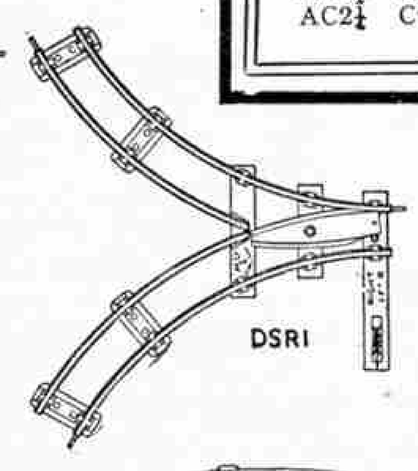


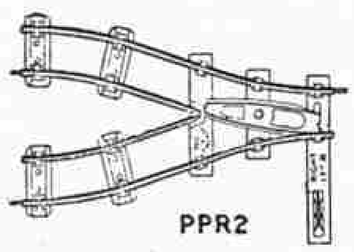


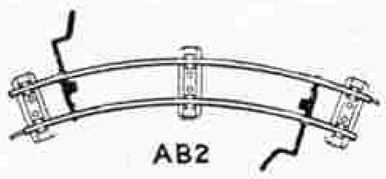


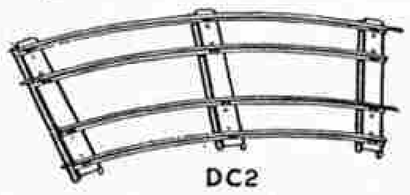


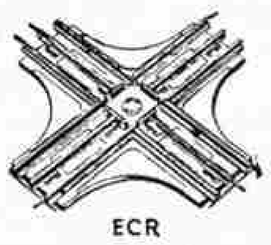


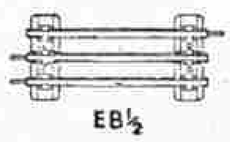


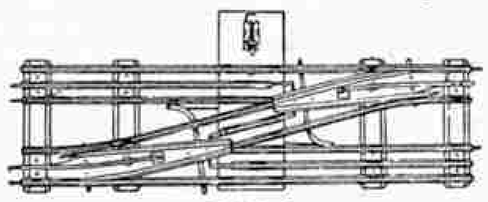


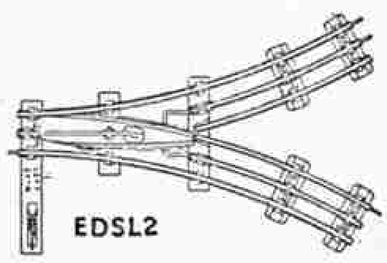


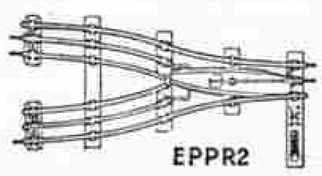


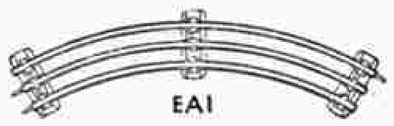


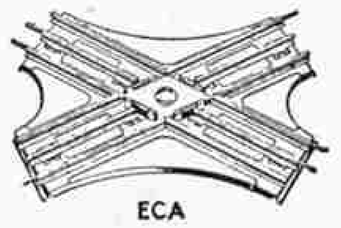


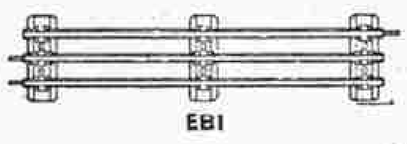












Hornby Rails, Points and Crossings are designed to meet the most exacting requirements of model railway enthusiasts. They make possible an almost endless number of realistic and railway-like layouts. Only the finest materials are used in their manufacture.

GAUGE O

ALTERNATE PEGS

Rails for Clockwork and Steam Trains

CURVED RAILS

9-in. radius (For MO Trains)

M9	Curved rails	doz.	3/-
MB9	Curved brake rails	each	3½d.

1-ft. radius

A1	Curved rails	per doz.	4/6
A1½	Curved half rails	„	3/6
A1¼	Curved quarter rails	„	3/-
AB1	Curved brake rails	each	6d.

2-ft. radius

A2	Curved rails	per doz.	4/6
A2½	Curved half rails	„	3/6
A2¼	Curved quarter rails	„	3/-
AB2	Curved brake rails	each	6d.
DC2	Curved rails, double track ...	½ doz.	7/6

STRAIGHT RAILS

BM	Straight rails (for MO Trains) ...	per doz.	2/9
B1	Straight rails	„	4/-
B½	Straight half rails	„	3/-
B¼	Straight quarter rails	„	2/6
BB1	Straight brake rails...	each	5d.
BBR	Straight brake and reverse rails ...	„	1/6
DS1	Straight rails, double track ...	½ doz.	6/6

DOUBLE SYMMETRICAL POINTS

For 1-ft. radius curves

DSR1	Double symmetrical points, right-hand	per pair	5/-
DSL1	Double symmetrical points, left-hand		

For 2-ft. radius curves

DSR2	Double symmetrical points, right-hand	per pair	5/-
DSL2	Double symmetrical points, left-hand		

PARALLEL POINTS

PPR2	Parallel points, right-hand... ...	per pair	5/-
PPL2	Parallel points, left-hand		

CROSSINGS

CA1	Acute-angle crossings (for 1-ft. radius tracks)	each	2/-
CA2	Acute-angle crossings (for 2-ft. radius tracks)	„	1/9
CR1	Right-angle crossings (for 1-ft. radius tracks)	„	2/-
CR2	Right-angle crossings (for 2-ft. radius tracks)	„	1/9

CROSSOVER POINTS

COR2	Crossover points, right-hand ...	per pair	12/-
COL2	Crossover points, left-hand ...		

POINTS

9-in. radius (For MO Trains)

MR9	Right-hand points	per pair	3/-
ML9	Left-hand points		

1-ft. radius

PR1	Right-hand points	per pair	4/-
PL1	Left-hand points		

2-ft. radius

PR2	Right-hand points	per pair	4/-
PL2	Left-hand points		
PSR2	Points on solid base, right-hand ...	per pair	8/6
PSL2	Points on solid base, left-hand ...		
RCP	Rail connecting plates	½ doz.	2d.

Rails for Electric Trains

CURVED RAILS

1-ft. radius

EA1	Curved rails	per doz.	6/6
EA1½	Curved half rails	„	4/6
EA1¼	Curved quarter rails	„	4/-

2-ft. radius

EA2	Curved rails	per doz.	6/6
EA2½	Curved half rails	„	4/6
EA2¼	Curved quarter rails	„	4/-
EDC2	Curved rails, double track ...	½ doz.	9/-

STRAIGHT RAILS

EB1	Straight rails	per doz.	6/-
EB½	Straight half rails	„	4/6
EB¼	Straight quarter rails	„	4/-
EDS1	Straight rails, double track ...	½ doz.	8/6

CROSSINGS

ECA	Acute-angle crossings	each	4/-
ECR	Right-angle crossings	„	4/-

POINTS

For 2-ft. radius curves

EPR2	Right-hand points	per pair	7/6
EPL2	Left-hand points		

DOUBLE SYMMETRICAL POINTS

For 2-ft. radius curves

EDSR2	Double symmetrical points, right-hand	per pair	8/6
EDSL2	Double symmetrical points, left-hand		

PARALLEL POINTS

For 2-ft. radius curves

EPPR2	Parallel points, right-hand	per pair	8/6
EPPL2	Parallel points, left-hand		

CROSSOVER POINTS

ECOR2	Crossover points, right-hand	per pair	24/-
ECOL2	Crossover points, left-hand		
TCP6	Terminal connecting plates (6 volt)	each	1/6
TCP20	„ „ „ (20 volt)	„	1/6

Electrical Points for 1-ft. radius curves are not supplied

Centre Rails for Converting Ordinary Track to Electrical

CURVED CENTRE RAILS

1-ft. radius

AC1	Curved centre rails	per doz.	1/-
AC1½	Curved centre half rails	„	9d.
AC1¼	Curved centre quarter rails ...	„	6d.

2-ft. radius

AC2	Curved centre rails	„	1/-
AC2½	Curved centre half rails	„	9d.
AC2¼	Curved centre quarter rails ...	„	6d.

STRAIGHT CENTRE RAILS

BC1	Straight centre rails	per doz.	1/-
BC½	Straight centre half rails	„	9d.
BC¼	Straight centre quarter rails ...	„	6d.

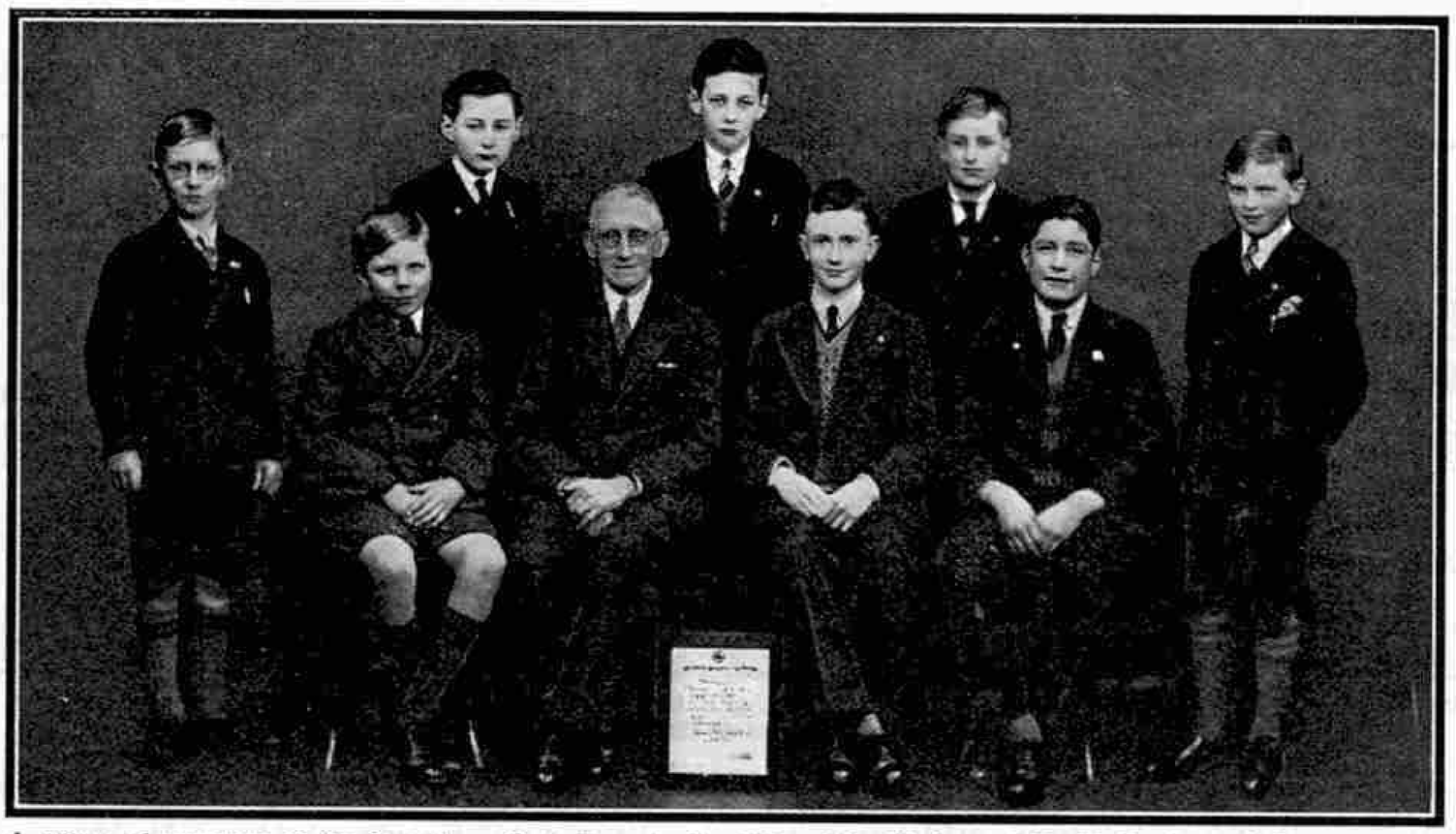
ICR	Insulators for insulating centre rails	„	3d.
CCR	Clips for fixing centre rails ...	„	6d.

Manufactured by - - MECCANO LIMITED - - BINNS ROAD - - LIVERPOOL 13

Branch Notes

EAST GRINSTEAD.—Traffic increased to such an extent that it became necessary to re-plan and extend the Branch track. The town and harbour stations at "Shotlake" have been thrown into one, and the station at "Foxborough" has been entirely rebuilt. The excavation of a long cutting also has greatly facilitated operations. Secretary: P. D. M. Pope, Waldegrave House School, East Grinstead.

WATERLOO-SEAFORTH GRAMMAR SCHOOL.—This recently incorporated Branch began with a temporary track representing the London-Dover main line of the S.R. A room in which a permanent layout may be constructed has now been obtained, and members are making trestles on which to support the track and preparing scenery and other accessories. A visit was paid to the L.M.S.R. Engine Shed at Edge Hill, where the chief attraction was the "Royal Scot" locomotive No. 6143 "*Mail.*" Secretary: D. Busby, 4, Winstanley Road, Waterloo.



A group of members of the Streatham Park Branch, No. 232. The Chairman, Mr. P. Doyle, and the secretary, P. J. B. Doyle, are in the middle of the front row. The Branch was incorporated in August last year, and members have specialised in timetable working on the excellent track laid down.

BELFORT (CATFORD).—On Competition Night entrants were required to show knowledge of British Railways and a pair of Hornby Points was awarded as prize. Visits have been paid to the S.R. Marshalling Yards at Feltham, and to Victoria, where the new electric "*Southern Belle*" was inspected. On track nights members have shown improvement in train formation and in operations generally, accidents being fewer now that a stationmaster is in charge at each terminus. The secretary would be pleased to hear from intending members. Secretary: J. H. Forth, "Gleneagles," 31, Ardoch Road, London, S.E.6.

SOUTH BIRMINGHAM.—Meetings have been held in a large garage, in which a splendid permanent layout was operated. Successful track meetings have been held, but unfortunately the garage is no longer available, and the secretary would welcome information in regard to a new Branch room. Secretary: E. Sharp, 156, All Saints Road, Kings Heath, Birmingham 14.

HOLYWELL (OXFORD).—New timetables have been arranged and better results have followed the determination to avoid overcrowding the Branch layout. The track is taken up and thoroughly cleaned at regular intervals. Visitors are encouraged in order to attract recruits. A magazine has been started to provide members with interesting railway news. Secretary: M. Weatherall, 29, Holywell, Oxford.

LORDSHIP LANE.—Membership has largely increased and the track has been extended in order to accommodate more rolling stock. The recent Exhibition was a great success, and the experience gained in preparation has proved valuable. An appreciative report of the realism of operations on the extensive Branch track appeared in the local press. A Lantern Lecture has been given on "*A Tour of Sunny Devon,*" slides being kindly loaned by the G.W.R. Secretary: R. L. Carrington, 49, Russell Avenue, Noel Park, Wood Green, London, N.22.

TAUNTON (NEATH).—Steady progress is being made with improvements and extensions to the Branch track. A Goods Yard has been constructed at "Somerton," and the establishment of a Coal Storage Siding at "Bonnington" has facilitated the despatch of trains. Telegraph poles have been erected and the work of providing electric lighting is now in progress. The layout is to be converted to double track throughout. Secretary: J. W. M. Alexander, Holway Cottage, Taunton.

NEW ZEALAND

CHRISTCHURCH.—A special "Open Meeting" was arranged in connection with Break Up Night. The Branch layout was operated and Meccano super models also were on view. Games and competitions were arranged and the President of the Branch gave an address and presented prizes earned early in the session. There was an excellent attendance of parents and friends. Secretary: J. C. Fleming, 52, Cowlishaw Street, Avonside, Christchurch, New Zealand.

Proposed Branches

The following new Branches of the Hornby Railway Company are now being formed, and boys who are interested and desirous of linking up with this unique organisation should communicate with the promoters whose names and addresses are given here. All owners of Hornby Trains or accessories are eligible for membership, and the various secretaries will be pleased to extend a warm welcome to all who send in their applications:—

DOUGLAS—A. Bott, 11, Queen's Avenue, Douglas, I.O.M.

LONDON—C. Godsmark, 90, Woodbine Grove, Penge, S.E.20.

NEW ZEALAND—Thomas McGavin, 55, Essex Street, Masterton.

PORTSMOUTH—A. Glanville, 8, The Broadway, Havant Road, East Cosham.

ROMFORD—C. R. Charlton, 132, Mawney's Road, Romford.

Branches Recently Incorporated

240. HOLLANDERS (SPALDING)—Mr. P. J. Draper, Halmer Gardens, Halmer Gate, Spalding.

241. WEST LEIGH (LEIGH-ON-SEA)—Mr. F. C. Cross, Knowle Villa, 129, Southsea Avenue, Leigh-on-Sea.

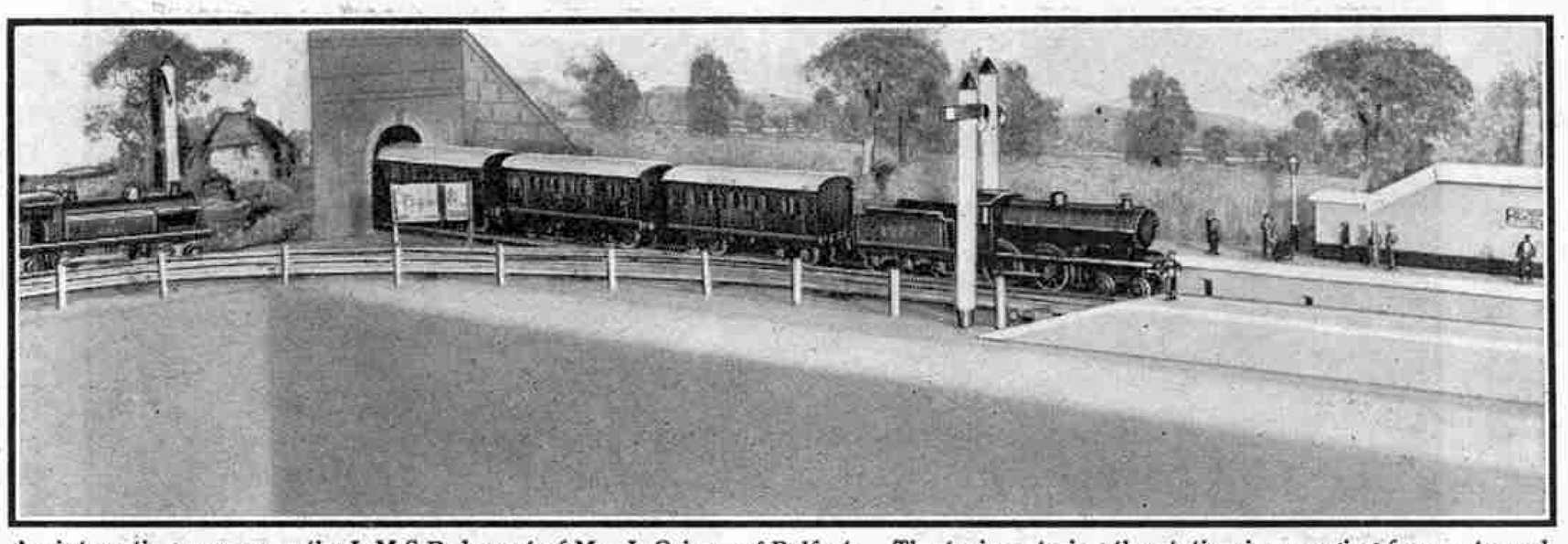
242. HARLESDEN METHODIST—Mr. G. B. Weightman, 165, Vivian Avenue, Wembley.

243. SUTTON AND DISTRICT—D. Wakely, Hillbury, Holland Avenue, Sutton.

LIII.—AN INTERESTING L.M.S.R. LAYOUT

THERE is no doubt that increasing interest is now being taken by Hornby Railway owners in layouts that are intended to represent definite portions of actual railway systems. From time to time complete lines arranged on this plan have been described in the "*M.M.*," and we have included a number of articles containing suggestions for possible working schemes based on real practice. The layout shown in the diagram on the next page will therefore be of interest, together with some remarks on operations that may be performed on it.

The system has been developed by an enthusiastic H. R. C. member, J. Geale, of Dublin, and he has based it on the L.M.S.R. main line from Euston to Crewe, together with the section from Crewe to Liverpool. The line is at present under construction, so that only the main outline of the scheme is shown. Various additions no doubt will be found desirable as the result of experience, in order to facilitate train operation.



An interesting corner on the L.M.S.R. layout of Mr. J. Grime, of Belfast. The train entering the station is emerging from a tunnel, which conceals part of the main line from the rest of the layout.

What we may term usual practice has been followed in the general layout. Thus an end-to-end run of reasonable length is possible, as the plan shows, and the main line in re-passing its starting point, Euston, is hidden in tunnel. It then proceeds to Crewe and so finally to Liverpool, the other terminus. In the course of normal working a train will follow this path, but a very useful feature has been introduced in the "through loop." This leaves Crewe and runs parallel with the Euston-Watford line, joining up with it at the latter point. In this way a continuous track is afforded for up or down trains whenever a long run is desired or called for in the working arrangements. This feature makes the working of Crewe station extremely interesting, as trains in both directions may be dealt with on both platform lines.

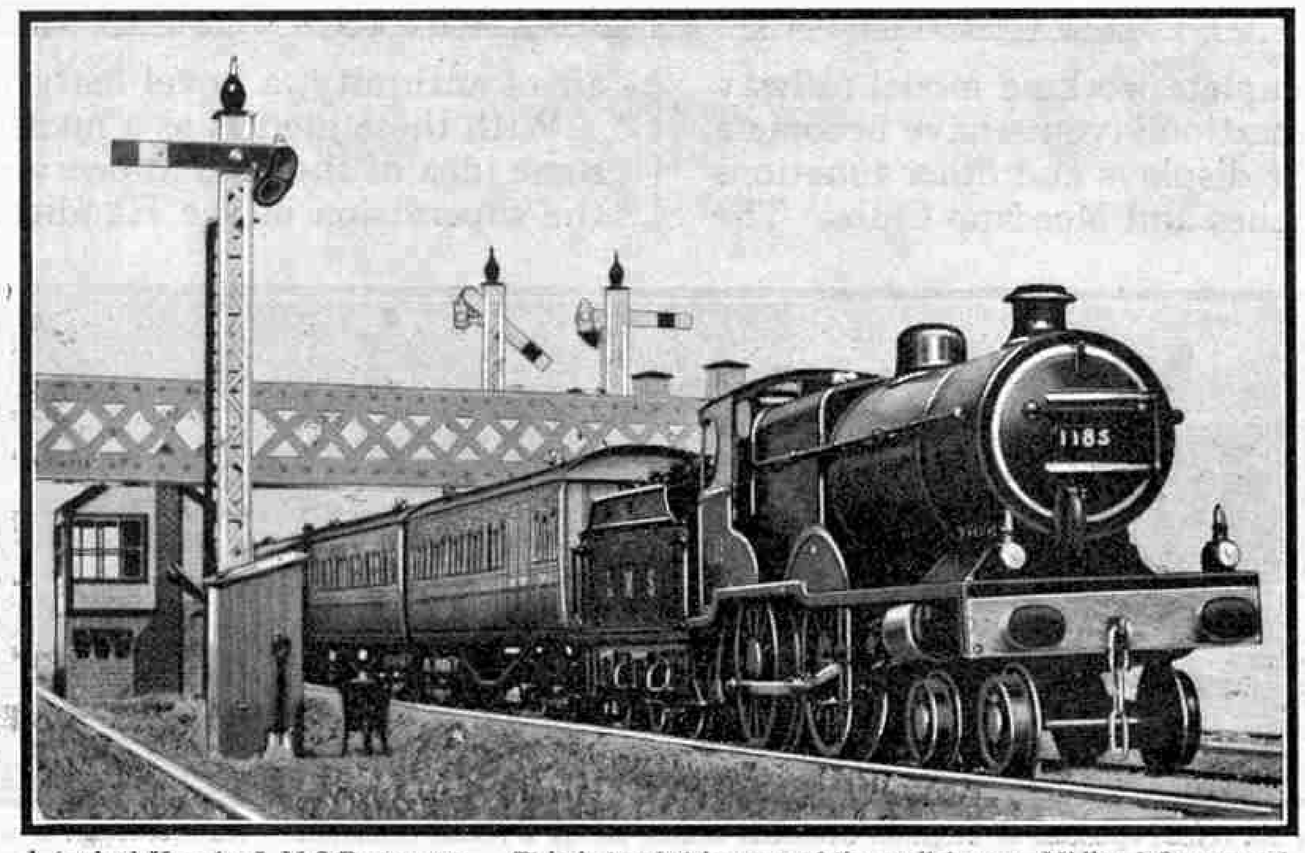
The diagram shows that accommodation for locomotives is provided at the Euston end of the line, the sheds standing at right-angles to the station in order to save space. The depot corresponds of course to Camden in actual practice, and this also applies to the goods lines and shed on the arrival side of the station. Two turntables are available on the system, one at each terminal point. They may be regarded as sufficient, as any local traffic at Watford would be dealt with by tank engines.

The layout as originally planned shows the main line from Crewe to Liverpool as a single track up to the parallel points situated opposite the turntable. As both these stations were to have long siding lines extending towards one another, however, we have drawn them as if they actually meet, the suggested portion being dotted. The two long sidings thus become a loop, useful in times of pressure, and particularly suited for up trains that are not required to stop at Crewe; as for instance "*The Merseyside Express*," that was dealt with in the January and February issues of the "*M.M.*"

It will be of advantage to readers generally if we deal with some suggestions for the equipment of the line in the matter of locomotives, rolling stock and other items. "Royal Scots" and Midland Compounds are to be seen regularly at Euston and Lime Street, so that the Hornby representations of these famous engines will be suitable for the most important duties on the line. Previous hints given in the "*M.M.*" in the matter of providing the former engines with dummy smoke deflectors should be applied. Suburban services may be worked by No. 2 Special Tanks. The black-finished Hornby 4–4–2 Tank Locomotive bears the number 6781, which occurs in the series of the real "Precursor" tanks, and so is representative of these well-known engines of the former L.N.W.R., which have been associated with the Euston and outer suburban trains ever since they were first built. Any local traffic between Liverpool and Crewe may be in the hands of tender engines, as is usual in actual practice. If this is the case, facilities for turning will be necessary at Crewe, in addition to the turntables provided at the terminal points. Possibly the Liverpool turntable might be moved somewhat and a

connection to it made from Crewe Station. This will be convenient, and not necessarily apparent from either station, though hardly according to actual practice!

Hornby No. 2 Saloon Coaches in the familiar L.M.S.R. red colour will do well for making up the chief trains, with tracing paper placed in front of their celluloid windows to imitate kitchen or sleeping compartments where these are required. Appropriate name and destination boards are included in the Hornby Series, and readers can easily make up any others that may be necessary, such as "*The Manxman*." This train provides a connection with the familiar Isle of Man steamers, hence its name; and this again reminds us of the boat trains that may be run on this layout when required. A separate station as at Liverpool Riverside would be interesting, but the limitations of space in miniature may necessitate the accommodation of boat trains at Lime Street.



A typical Hornby L.M.S.R. express. This is hauled by one of the well-known Midland Compound Locomotives, which are very suitable for express work.

In addition to their normal use in the formation of the principal L.M.S.R. trains, many readers employ No. 2 Saloon Coaches to imitate the well-known L.M.S.R. "electrics" that run between Watford and Euston. Actually no motive power is used, and the operator's hand supplies the necessary "juice." The running of a train in this way makes the installation of signal gantries, overbridges, and similar items more or less impossible, but this may depend on the particular operator. When the conditions are favourable, junior members of the staff might be put in charge of such an "electric" train, working a "shuttle," or "there-and-back" service. Owing to the position of the crossover points approaching Euston, such a train will have to arrive and depart from the inner face of the shorter platform. On arrival at Watford the train will have to run forward on to the single line section after completing its station duties, and then return on the up line; but this may be avoided if a trailing crossover is arranged at the Euston end of the platform. However, such detailed arrangements for local traffic will depend on the choice of individual railway owners.

An interesting train to include in the working programme would be a miniature express goods from Camden to Liverpool, representing the real "7.45 p.m. Express Freight" that makes the longest non-stop run of all freight trains in Great Britain. The No. 1 Special Locomotive is the obvious choice here in the matter of engine power, as for other similar trains. The train itself may be composed almost exclusively of wagons sheeted with Hornby Tarpaulins, and various vans. A large amount of meat traffic, both chilled and fresh, is dealt with at Liverpool, so that Hornby Refrigerator and Meat Vans can be put to good use on such a layout as this. Banana traffic, too, may be featured with advantage, for a great quantity of this fruit is handled on Merseyside, the L.M.S.R. port of Garston being particularly well known in this connection.

Where special trains of this kind have to be run at short notice, the suggested extension of the Liverpool and Crewe siding lines into a loop will show its usefulness. In addition to this loop a connection from it to the adjacent platform line at Crewe would be useful, and would widen the scope of traffic working considerably. Again, at the Euston end of the line, if the right-hand crossover points were replaced by a left-hand pair situated between the engine shed points on the down line and the yard points on the up line, goods trains would be given a straight run out of the yard on to the main line. The right-hand crossover points might be moved to come at the facing end of the engine shed points. These alterations would result in departures and arrivals being possible from all platforms, a matter of considerable advantage in that shunting is reduced. It means of course that arriving engines are trapped until the train departs again, but in miniature such turn-rounds are usually quite rapid. In any case the engine that brought in the train can usefully assist it out until clear of the engine shed points.

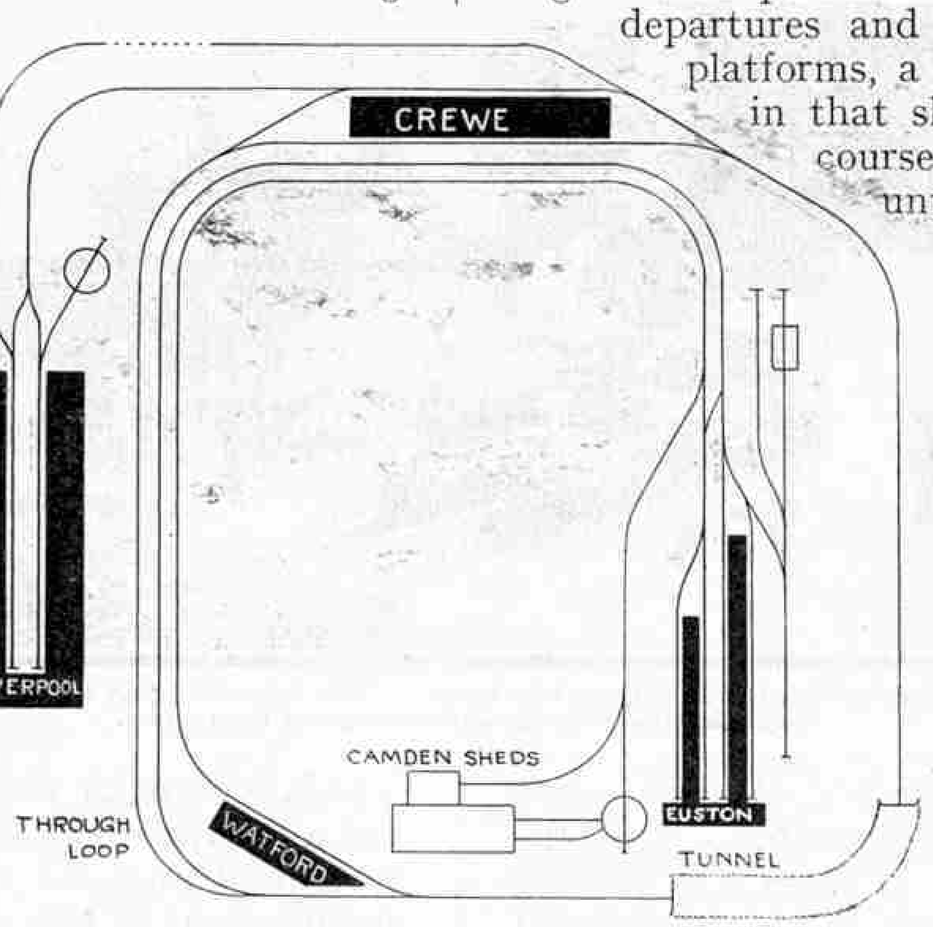


Diagram of the layout referred to in this article.

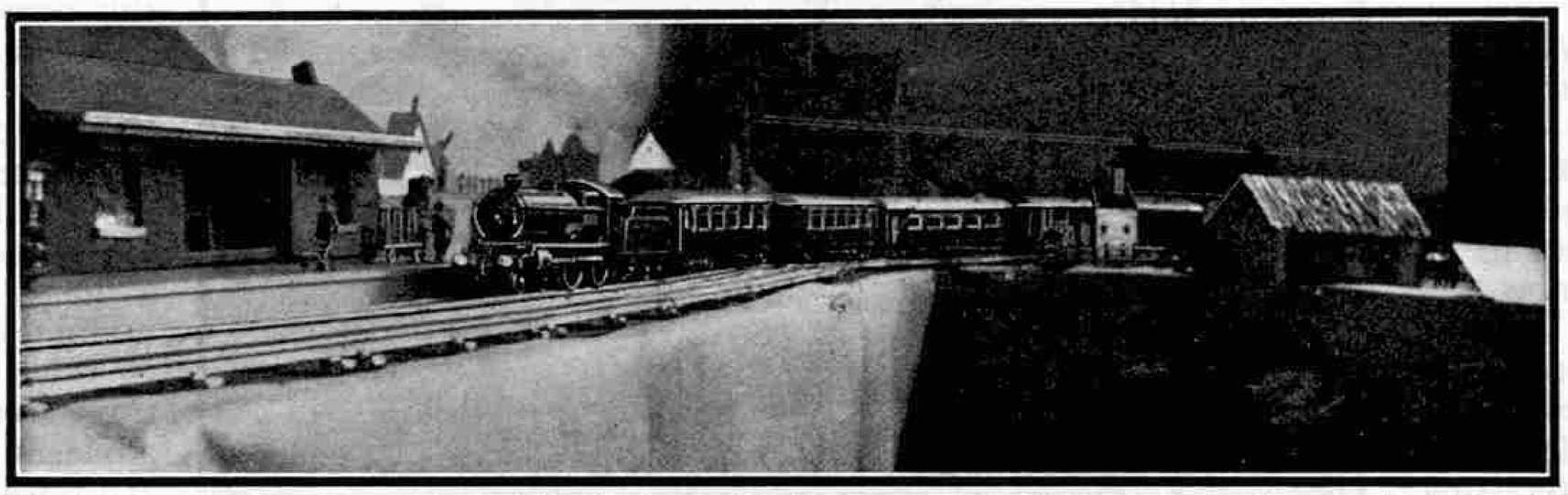
This banking is a feature of L.M.S.R. practice at Euston, and St. Pancras, too, as we have mentioned before. Where automatic couplings are in use, special measures will have to be taken to prevent the engines and coaches from coupling up again. A match-stick, sharpened slightly and jammed between the upward projecting tail-piece of the loop and the stop-piece formed on the hook, will prevent such unwanted coupling up occurring.

A characteristic feature of the Western Division main line is the numerous sets of water troughs, and it will be interesting to imitate these installations in miniature in one spot at least. The use of actual water is of course out of the question. A convenient length of wood about half an inch wide may be shaped and painted to represent a trough. When placed on the sleepers its height should not exceed that of the rails.

An Interesting Exhibition Layout

Enterprise at Brighton Grammar School

THE fascination of a complete working model railway is great, and demonstration layouts have become a popular feature of the displays and other functions organised by H.R.C. Branches and Meccano Clubs. The different operations are invariably watched by visitors with keen interest, and as a result of such practical demonstrations even the most sceptical are usually convinced of the attraction of the hobby.



The terminus of the layout operated at Brighton Grammar School during a recent exhibition. An aerodrome is situated close to the line at this point.

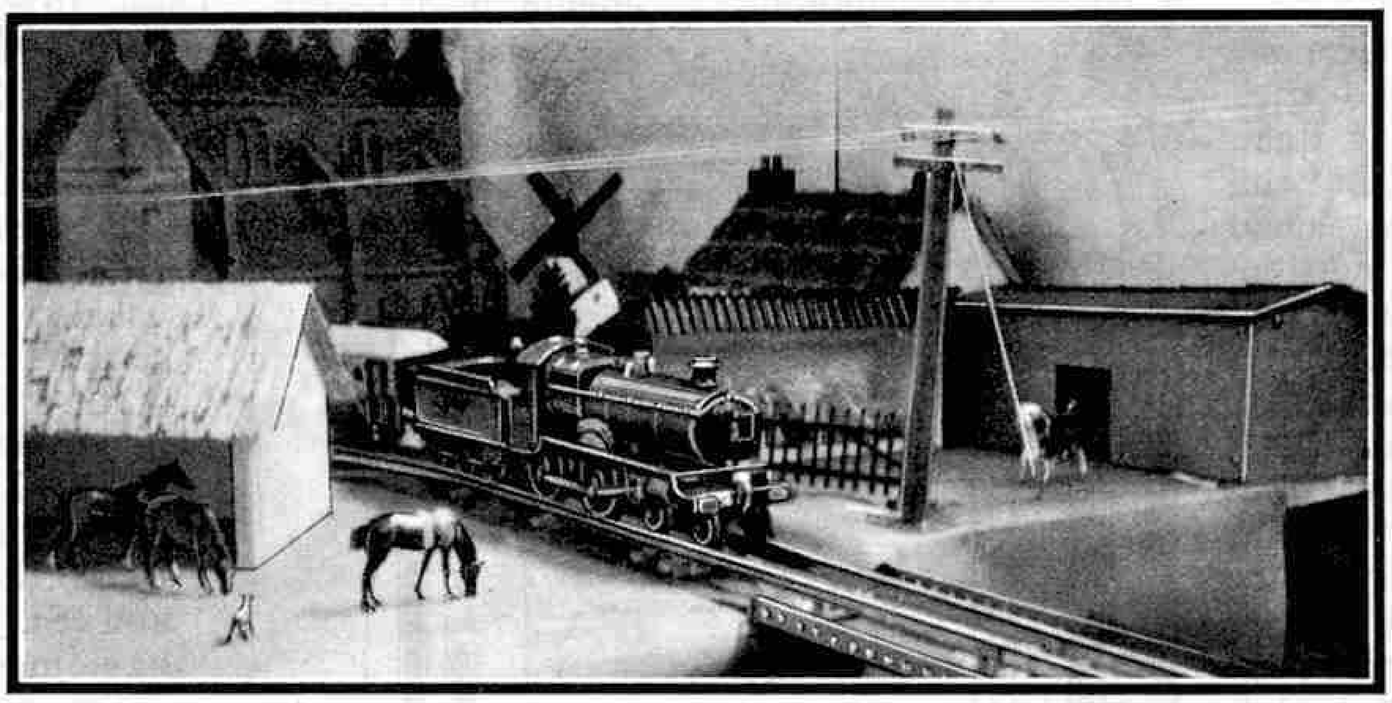
When plans were being made for an Exhibition of work in the Junior Department of the Brighton Grammar School it was felt that interest would be stimulated if a model railway were incorporated. The scheme was taken up with enthusiasm by the boys, of whom there are 90 between 8 and 11 years of age, and they were all eager to lend their materials.

In order to make the railway as realistic as possible it was decided that the line should pass through appropriate surroundings, such as a model countryside and a miniature town, and the boys were invited to make individual models for these. A large variety of pieces was the result. Most of them were products of the unaided efforts of the boys, and were representative of each one's ingenuity in design and skill in construction. Even the youngest boys brought such items as lengths of fencing made of matchsticks, and the larger models were built by the older boys.

The pieces for the countryside were produced in bright colours, and included a thatched farmhouse with barns and outbuildings. A Gothic church was copied in wood from a local example. As a contrast the pieces for the town were painted dark shades of old stone. There was a church of modern design, a gasworks with gasometer, and several workmen's cottages. A model of a Norman keep gave the town some claim to historical interest, and invested it with a considerable air of antiquity, a novel feature in such miniature work.

With these models as a nucleus it was possible to form some idea of the final appearance of the railway. Under the supervision of the Handicrafts Master the youngest form made signals, telegraph poles and bridges in the school workshop; and another form departed slightly from their ordinary art work in order to prepare scenic backgrounds to line the walls. Behind the town was placed a dark silhouette of roofs and chimneys, and the country was backed by a landscape of woods and hills.

The form of the layout was partly determined by the permanent fixtures in the room allotted for the Exhibition, and partly by the fact that it was necessary to leave space to permit visitors to inspect exhibits on the walls. The track was laid on flat-topped desks, and in three places it was carried over gaps on simple viaducts built of Meccano parts. It was suggested that sand should be used as ballast, but this scheme was abandoned on account of the risk of spreading grit. Strips of dark paper were found to make an effective substitute.

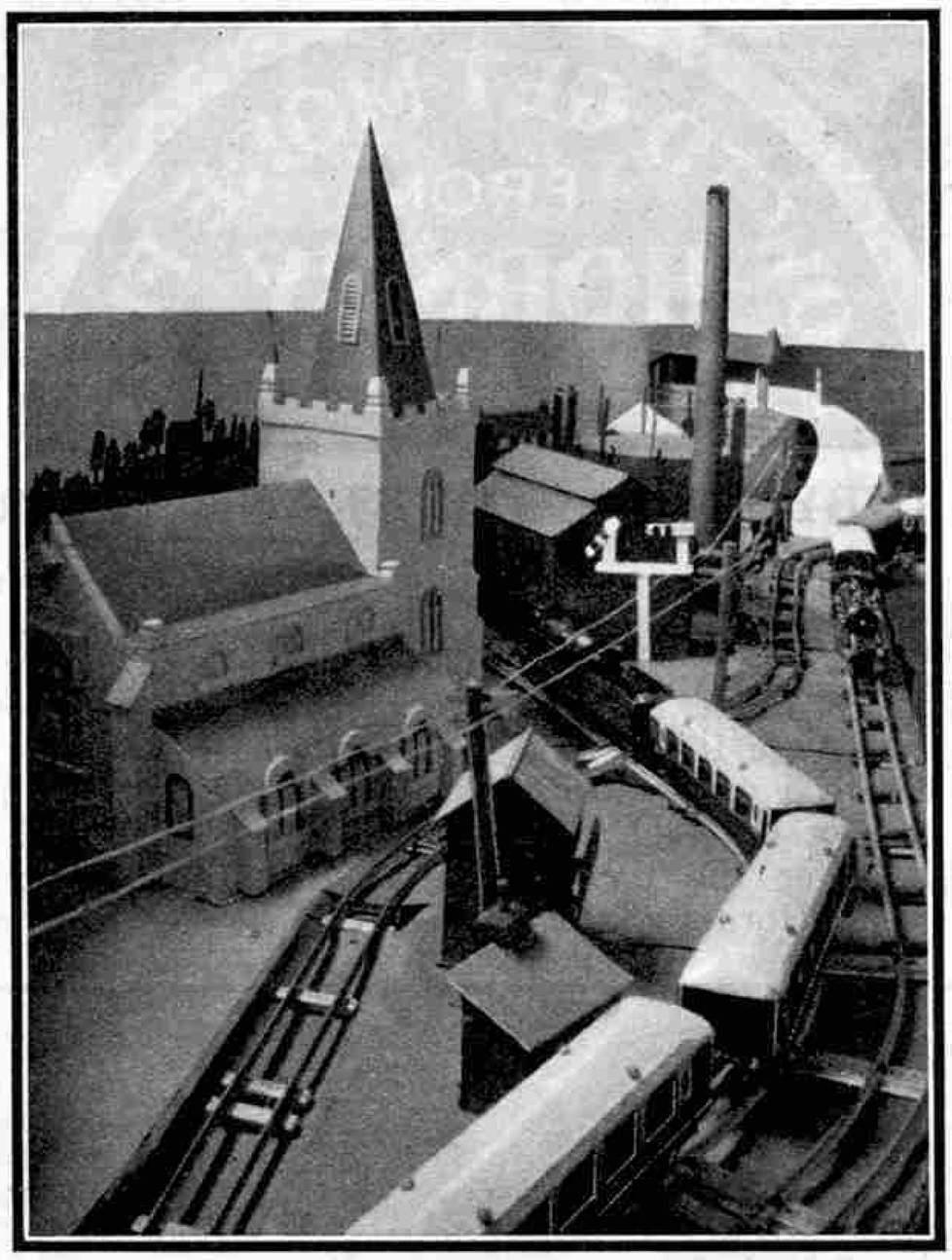


A Pullman train passing through the village on the layout. The various buildings are realistic in appearance and add greatly to the attractiveness of the scheme.

The accompanying diagram shows the ultimate form of the layout. On one side of the room was a dock, with a siding for boat trains, and an elaborate system of lines for marshalling the goods trains. The arrangement of this part of the line is interesting, as the various loop lines and the turntable allowed the arriving locomotives to run round their trains, and to be turned facing the outgoing direction during the process. The practice of placing the turntable at the end of converging loop lines in this manner is useful and saves space, which is always a good point. Leaving the dock premises the line passed over one of the Meccano viaducts referred to previously and into the town station which, together with the three other stations and two goods platforms, with a warehouse for the goods depot, was made by the

boys. The path of the trains then ran over the acute angle crossing shown in the upper illustration on this page, and so into the central oval part of the layout.

Opposite to the town was another station and a goods depot. Near this station two routes became available by means of parallel points, the inner one providing a continuous run past the station and halt and then round to the double road viaduct shown in the diagram. The other or outer road ran parallel with the inner for some distance, but did not serve the station and halt, and shortly after passing the latter branched off to connect with the acute angle crossing. After passing through a further part of the town and over the viaduct shown in the lower illustration on page 384, the surroundings became more rural, various farm buildings being visible in the illustration.



Two trains passing by the town between elaborate models of a church and a gasworks.

Approaching the village station the track widened out into loop lines which, together with the turntable, as at the other end of the line, allowed arriving engines to be made ready for departure in the shortest possible time—an important point when working "end-to-end" services with tender engines on a layout of this kind. This country terminus was placed near an aerodrome, of which the principal feature was a three-engined biplane constructed of Meccano.

The track and rolling stock were lent by the boys, and consisted almost entirely of Hornby material. Apart from the rails, trains, and one or two miniature figures, nothing was included in the railway that had not been made by a member of the Junior School.

An express train was run backward and forward between the dock and the aerodrome. It consisted entirely of Pullman cars, and occasionally ran double-headed drawn by "*County of Bedford*" and "*Caerphilly Castle*" locomotives. Goods trains were operated between the dock and the central depot, and a local train ran through the town on the inner line of the central oval. These trains ran according to a timetable, so arranged as to give ample time for winding the locomotives, without leaving long intervals during which no trains were running. They were operated by a staff of eight boys posted at strategic points. The controller at the central station was able to signal that the line was clear for trains leaving the termini by means of lamps concealed in the signal boxes, and the electric wires for this purpose were carried on telegraph poles beside the track in a realistic manner.

The Exhibition was open for a fortnight and was visited by at least 200 parents and friends, in addition to boys from the Senior School, and it is gratifying to note that a considerable sum for the School Charity Fund was realised. From every point of view the Exhibition was a success, and to this the railway layout had contributed in no small measure. The boys who were able to see their rolling stock running in longer trains and on a more complicated track than would have been possible at home, were undoubtedly much more keen on the Exhibition as a whole than they would have been if it had consisted solely of school work. But the inclusion of the railway was not merely an attempt to "sugar the pill." It proved itself to be of real educational value in two important respects. In the first place it was a co-operative effort in which every boy had a chance to take part, however little his ability; and in the second place the actual building of the railway brought about a co-ordination of the boys' hobbies with their handicraft and art work such as is seldom possible in the ordinary course of school activities.

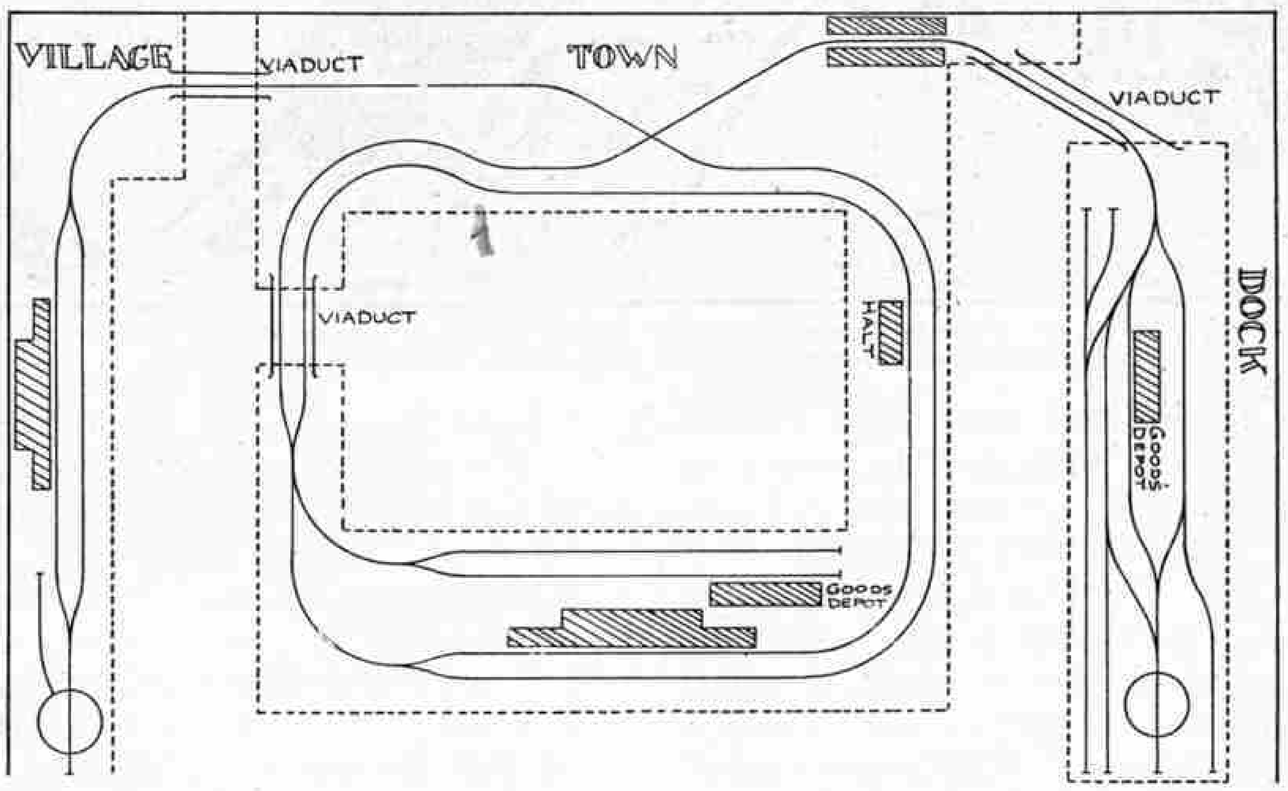
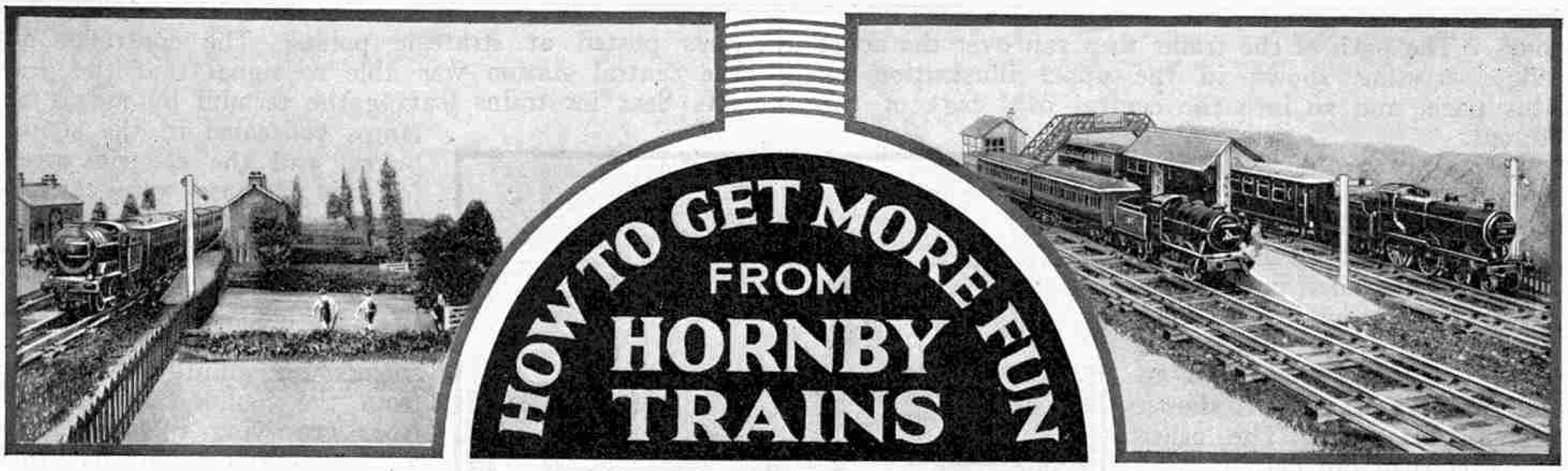


Diagram showing the arrangement of the layout.

The form of layout shown has a great deal to recommend it, and members of H.R.C. Branches will no doubt study it with some interest. Continuous working round the central oval track is quite possible, or end-to-end runs from the Dock to the Village may be made when required. Operators can easily and quickly reach either terminus from the central portion of the line, although the trains have some distance to travel between these points.

For similar layouts the Countryside Sections recently introduced are very useful and effective. They can be employed in connection with home-made accessories, and provide ready-made fields, hedges and roads, which it would be difficult to reproduce otherwise for display purposes quickly and easily.



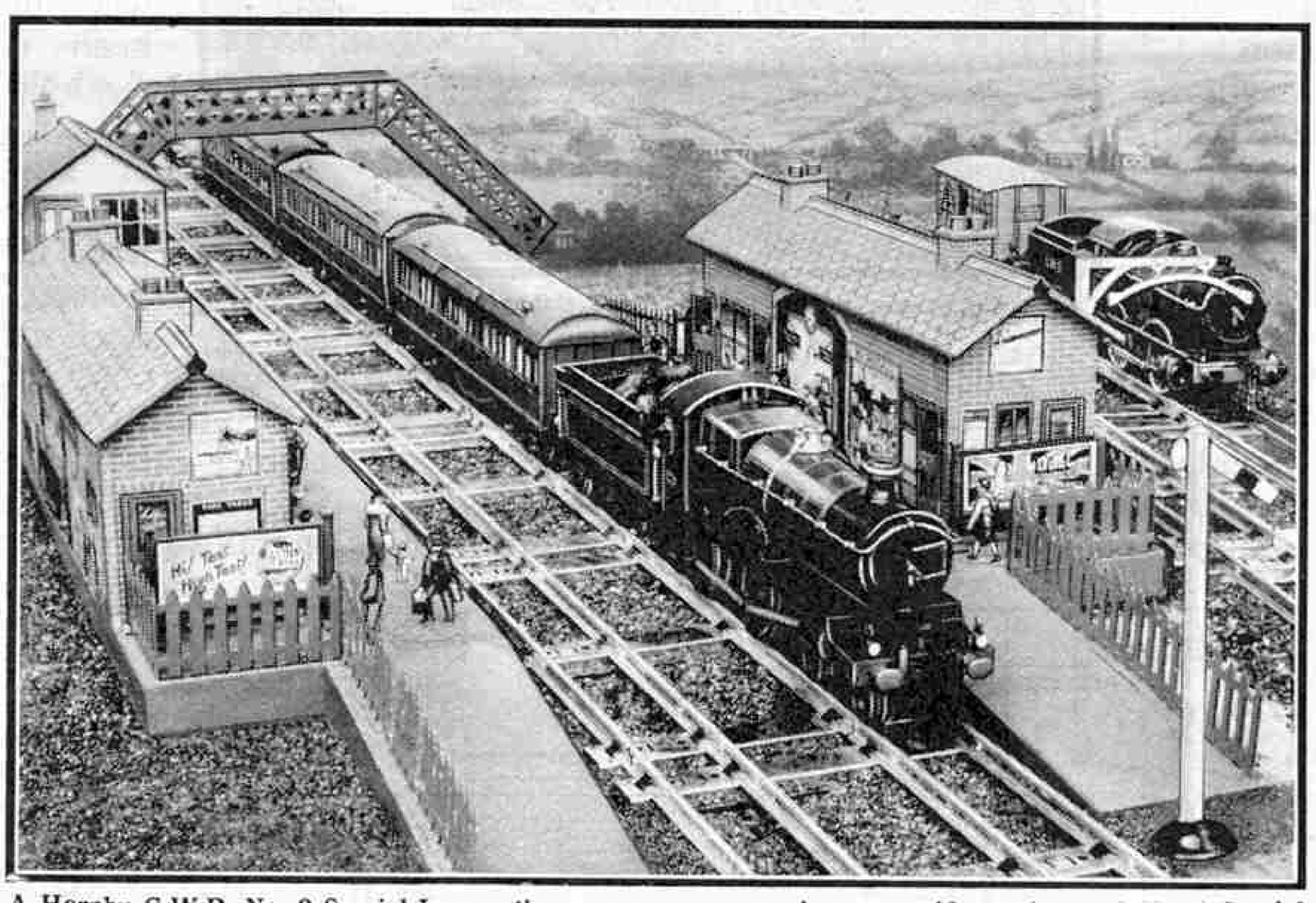
LV.—HORNBY LOCOMOTIVES AND THEIR DUTIES

IN the course of articles in these pages dealing with suggestions for train working on the lines of actual practice, we have frequently referred to the use of various Hornby locomotives for the different duties involved. It will be of interest to devote this article to a more detailed survey of these locomotives, with special reference to their suitability for different purposes. We shall confine ourselves for the present to the clockwork locomotives of the Hornby Series, leaving the electric types for future consideration.

The Hornby Railway owner is faced with many of the problems that confront the locomotive running superintendent on an actual railway, but his problems are less serious and are on a much smaller and simpler scale. Considerations of weight do not worry the miniature locomotive superintendent, and the first and in many respects the most serious problem with which he has to deal is concerned with curves. Where space is so limited that only curves of 1 ft. radius can be employed, the largest locomotives and rolling stock cannot be used, so that the railway necessarily loses a good deal in impressiveness and in realism generally. On the other hand a good layout with these small curves, together with a fair variety of locomotives and rolling stock is better than a small layout with the 2 ft. radius curves cramped into a space that is really much too small for it. The larger radius curves should certainly be used where space permits, however, for then the whole range of Hornby locomotives, coaches and wagons is available. Any Hornby locomotive in good working order will negotiate these curves safely at speed, even when running light.

The biggest engines in the Hornby Series are those of the No. 3 type. Although they are 10-wheeled engines, they are very flexible on curves, for the fixed wheelbase represented by their clockwork mechanisms is centrally disposed. The leading bogie and trailing pony truck look after the negotiation of curves in a satisfactory manner. The movements fitted are of the most perfect type, and the engines therefore are well suited for strenuous duties on fast and heavy trains.

Passenger work is of course the true sphere of these engines, which are finished in the passenger liveries of each group, but there is no reason why they should not take turns when convenient on fast goods trains. This is frequently seen in actual practice, for the speed and haulage capacity of the modern locomotive can be employed to advantage on such work if there is no suitable passenger duty offering. With their true-to-type tenders the No. 3 Locomotives are imposing in appearance, and are popular with Hornby Railway owners for use on miniature expresses. These may represent the famous trains of actual practice, with which the names of these locomotives, "*Royal Scot*," "*Flying Scotsman*," "*Caerphilly Castle*" and "*Lord Nelson*" are associated as a rule.

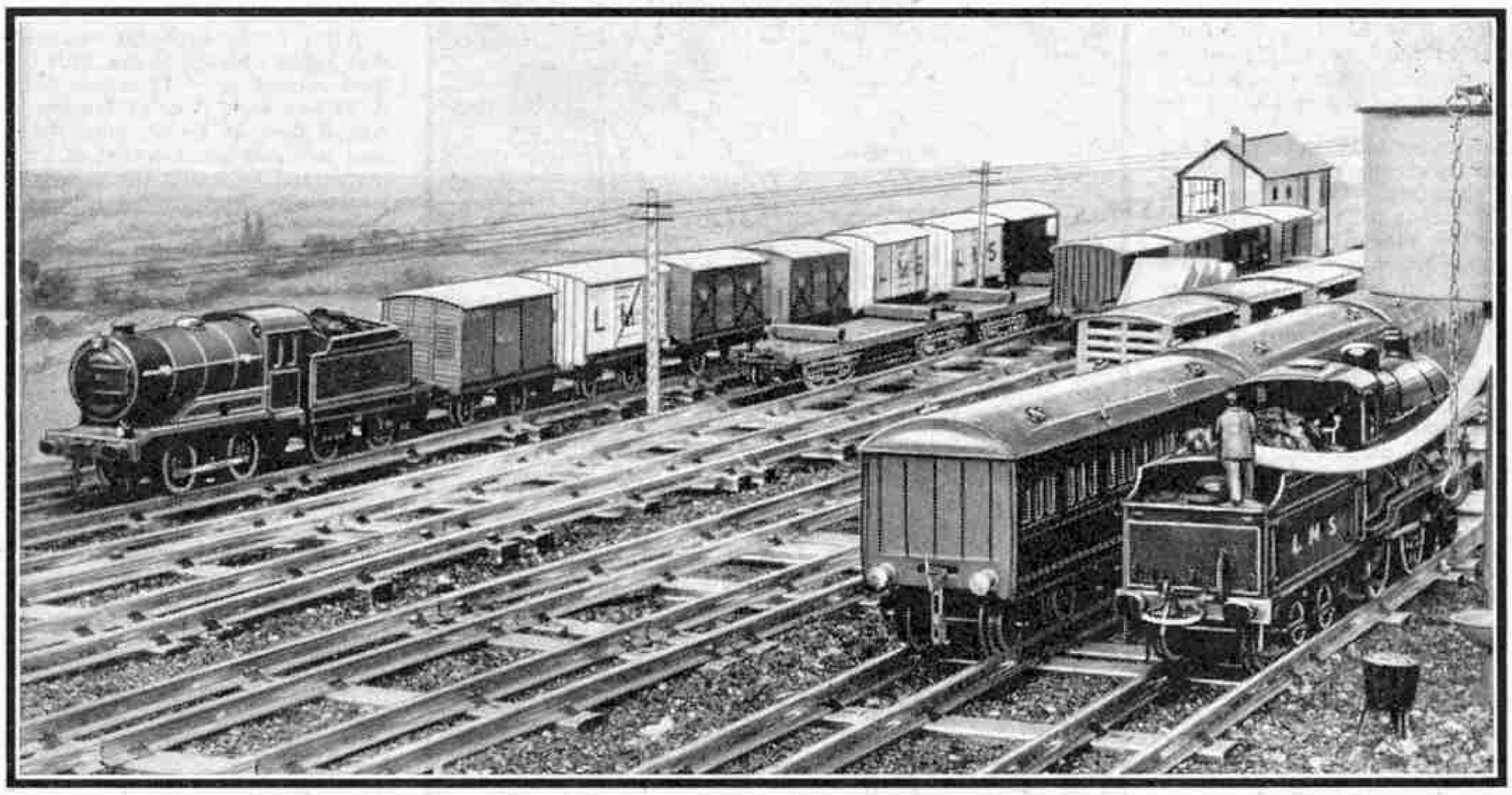


A Hornby G.W.R. No. 2 Special Locomotive on an express passing a wayside station. A No. 1 Special Locomotive is shunting in the yard in the course of ordinary goods duties.

We must not forget the famous "Nord" Locomotive of the Hornby Series, well known in connection with the Riviera "Blue Train" Set. This is similar in general style to the engines just mentioned, but is definitely Continental in details, such as the boiler mountings and colours. The bogie tender, too, is of a type favoured in France. The work of this engine will be similar to that of the British type engines mentioned, and we may remind readers that special attention was given to Continental train working in the "*M.M.*" for June and September of last year.

The next engines to be considered are great favourites, for they are splendid reproductions of definite prototypes. Their inclusion in the Hornby Series reminds us of the advanced forms of the popular 4–4–0 wheel arrangement that are now in real service. The engines featured in this Hornby No. 2 Special Series are particularly interesting. The L.M.S.R. example represents a three-

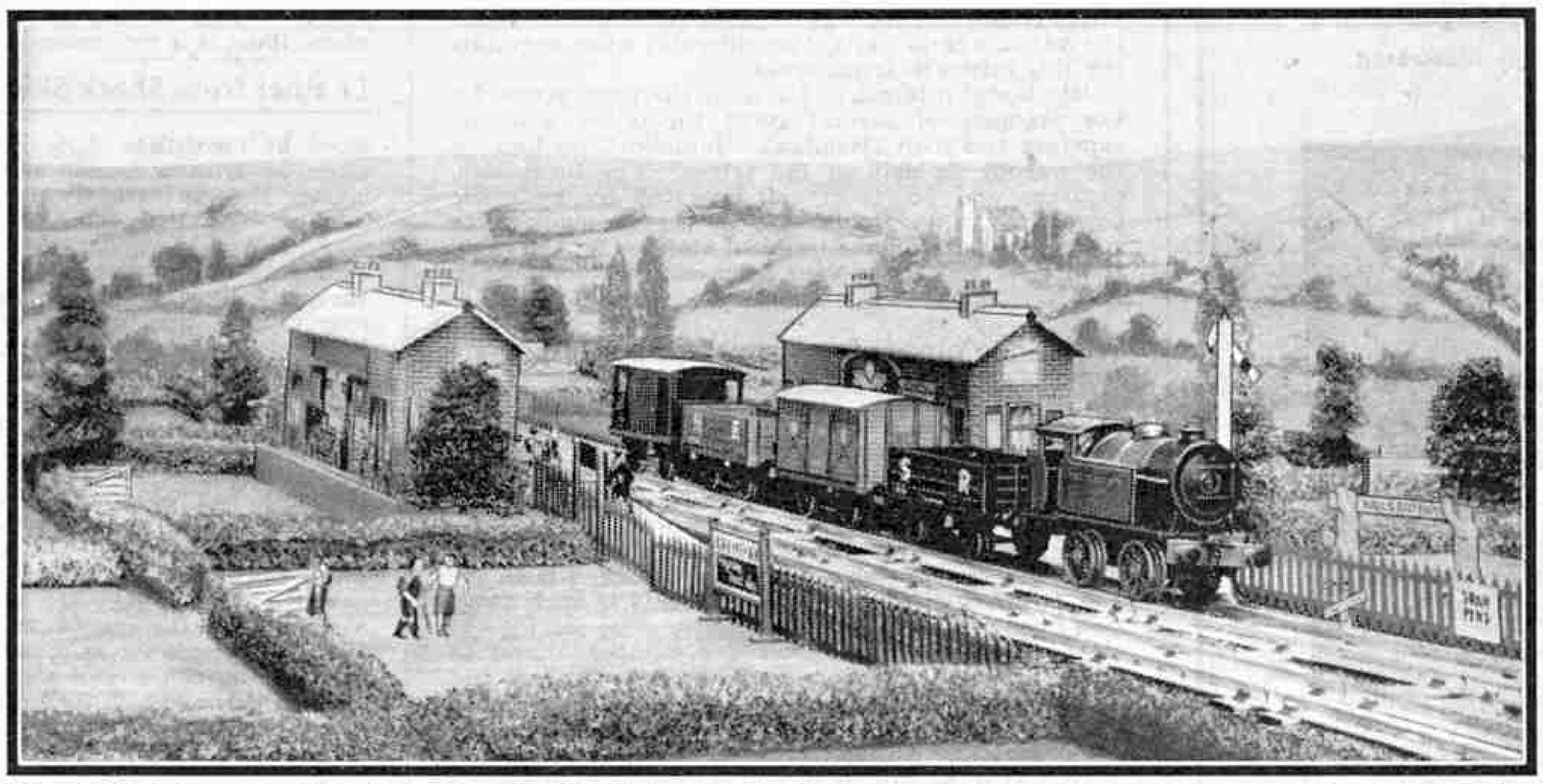
cylinder compound type of engine; the L.N.E.R. is a three-cylinder simple, and the Great Western is an ordinary outside-cylinder 4–4–0. The Southern Railway example has the typically British inside-cylinder arrangement. These Hornby 4–4–0s, like the actual engines, are comparatively large, and they have the same clockwork mechanisms as the No. 3 engines. They are therefore essentially fast passenger engines, although express goods work may be done by them, and they have been illustrated on many occasions in the "*M. M.*" when engaged on both goods and passenger work.



A train of perishable goods in charge of a No. O Locomotive passing extensive sidings. These locomotives have a strong resemblance to the ordinary British goods engines.

Instead of taking the obvious step of turning to the No. 2 Special Tank, we will proceed with the tender engines. The Tank Locomotives of the Hornby Series had a special article to themselves in November, 1931, and the range as regards types and classes has not been greatly altered since that date.

This brings us to the No. 1 Special Locomotive, which may be regarded as one of the handiest engines in the Series. It is of pleasing modern design, and is quite imposing in appearance, in spite of being a four-wheeled engine with a four-wheeled tender, and of medium total length. Its moderate wheel diameter and simple wheel arrangement give it very satisfactory hauling power, and at the same time its length of run is an important feature. For practically any duty, except the heaviest expresses and the slowest branch trains, the No. 1 Special is very suitable. A point to remember is that it can be accommodated with its tender on the Hornby No. 2 Turntable, so that layouts in which this accessory forms the only means of turning locomotives may well include the No. 1 Special among their equipment.



The M3 Tank is very suitable for local work of light character. Here a locomotive of this kind is seen on a short goods train.

The range of work of this locomotive makes it as indispensable on an up-to-date line as the numerous "Moguls" or 2–6–0 locomotives used for miscellaneous working on the four groups. To obtain the best results it should be used on 2 ft. radius curves. It will hold the rails on 1 ft. radius curves and points, but its hauling power and length of run is considerably affected by the increased resistance of these smaller radius rails.

The No. 1 Locomotive is a somewhat smaller version of the No. 1 Special, and the same kinds of work may be laid out for it, although its capacity is not equal to that of the bigger engine. Up-to-date features characterise its general lines, and like the No. 1 Special it has outside cylinders and steam pipes and a similar type of cab.

Traditionally British design is followed in the No. 0 Locomotive. It may practically be described as the No. 1 Locomotive minus the outside cylinders, but this similarity does not extend to the mechanism. The No. 1 Locomotive, like all those described before it, can be braked or reversed from the track, or by means of the cab controls. The No. O Locomotive, on the other hand, and those in order below it with reversing mechanisms, can only be braked from the track, and have to be reversed by hand from the cab. This does not prevent the engine from being extremely useful, however. For passenger or goods trains of moderate weight it is very suitable, and is employed by many Hornby Railway owners as representative of the familiar 0–6–0 type, which has been, and still is, widely used in actual practice.

Readers will realise that the No. 1 Special, No. 1 and No. O Locomotives are equally suitable for passenger or goods work, and this dual-purpose character is reflected in their colouring, for they may be obtained finished in "passenger engine" style or in the more sober "goods" fashion of the four groups. Engines of each kind can therefore be employed on the

(*Continued on page 388*)

How to Get More Fun—(*Continued from page 387*)

same layout without their similarities being too apparent, although in these days of numerous standard engines on each group system such resemblances can hardly be considered a fault.

The No. 2 Special, No. 1 Special and No. 1 Tank Locomotives correspond in appearance and capability to the tender engines of the same types. They may therefore be used on similar work, but preferably of more local character, although some surprisingly long mileages are covered by the bigger tank engines nowadays in actual practice. The No. 2 Special Tank is quite a large engine, and may be employed on secondary expresses, and on long runs where there are several long stops to enable the Water Tank to be visited.

The No. 1 Special Tank is essentially an engine for a great variety of work, and its sturdy nature makes it very suitable for heavy shunting. Its usefulness is further increased by the fact that it can be accommodated in the smaller of the two Hornby Engine Sheds, the No. 1. On a layout where space is restricted this is a considerable advantage. Similar though lighter duties may be carried out by the No. 1 Tank.

As regards their colouring and the details of their mechanism, these three types of tank engine are similar to the corresponding tender type.

The M3 Tank is smartly finished in passenger colours only, and is an obvious suggestion for light, local and branch traffic. Lines having intensive suburban services of light trains at frequent intervals may employ this engine to advantage.

Musta Bridge, Malta—A Correction

We regret that an inaccurate description of Musta Bridge, Malta, was given by the contributor of the article "*A Crumbling Span of Steel*" that appeared in the "From Our Readers" section of the "*M.M.*" for February last. Musta Bridge was erected and is maintained by the Royal Engineers, and our attention has been drawn to the inaccuracies by Major Carter Staff Officer of the Royal Engineers in Malta. Major Carter informs us that the steelwork of the bridge is not corroded, and that the structure is not closed to traffic, the existing limit of three-ton loads being that imposed when the bridge was built, and we are glad to give publicity to this correction.

The prompt detection of these errors affords another interesting example of the widespread circulation of the "*M.M.*" and the care with which it is read. Enquiries regarding articles often reach us many months after their publication, showing that the magazine is not only read on its appearance, but also is retained and treasured by its purchasers.—*EDITOR.*

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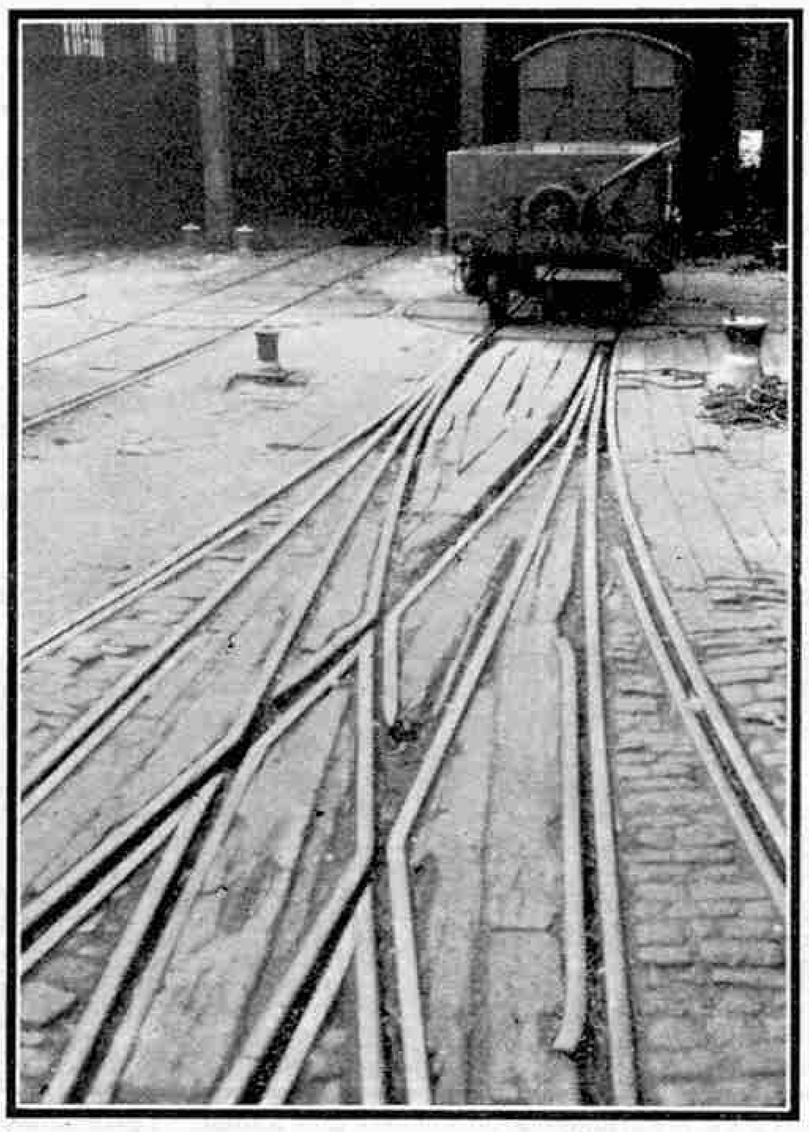
"Points Within Points"



At Willow Walk, one of the principal S.R. London goods depots, there is a particularly interesting example of multi-switch points. This appears in the above illustration, which shows the switch rails and some of the crossings involved where no less than four roads diverge from a single pair of rails. They are almost symmetrically disposed, all the switch rails being alongside one another, with their effective length graduated in order to allow the wheels to roll freely to the road required. Such an arrangement of course would be out of the question on a high-speed line owing to the danger of the wheel flanges "splitting" the switch rails. Six crossings in all are incorporated in this remarkable set of points, although only three of them are shown in the illustration. Ample provision is made in the way of check rails, and no doubt the wagon wheels "talk" considerably when negotiating this intricate arrangement.

Additional interest is given to the photograph by the presence of several small turntables and the capstans and their attendant "dummies" for hauling the wagons on and off the tables. The turntables, capstans and points are all operated by hydraulic power. Such turntables are in use in many large goods depots and some terminal stations for the rapid transfer of wagons or vans from one road to another.

Air Line Companies—(*Continued from page 345*)

experimental air mail service between England and Australia, in conjunction with Imperial Airways Ltd. The 2,000-mile stage of the journey between Brisbane and Darwin was allotted to "*Qantas*," and a close timetable was observed on the trip.

In the same year an unsubsidised air mail and passenger service also was opened between Brisbane and Townsville, operating twice weekly in each direction over the 728 miles of the route. The service was closed down, however, after five months. Later in the year another service, between Daly Waters and Birdum Creek, was opened up. This was carried out successfully until the termination of the contract at the end of March 1932.

Last year an interesting feature of the company's work was concerned with the outbreak of "gold fever" at Cracow, a number of trips being made by aeroplanes carrying city financiers and investors interested in the goldfield. The workings are in a very inaccessible spot and by surface transport the trip from Brisbane occupies four days. By aeroplane, however, Brisbane can be left at 7 a.m., the field reached at 10 a.m., and after having four hours in which to look round, the visitors can leave at 2 p.m. and reach Brisbane at 5 o'clock.

On one trip made in a D.H. "Puss Moth" the 230-mile run between Cracow and Brisbane was flown non-stop in 2 hr. 5 min. On this occasion the aeroplane climbed to a height of 10,200 ft. in order to take full advantage of a following wind. At about 10,000 ft. the cold was intense, but owing to the cabin heater with which the machine was fitted, no discomfort was experienced by the occupants.

No new routes or extensions were opened in 1932, but efforts are being made to assist in the establishment of the Australian end of an Imperial air mail service between Australia and England.

Famous Admirals—(*Continued from page 331*)

aid siege to Louisburg so effectively that on 26th July of the same year the French garrison of 6,000 men surrendered. A division of the fleet was then sent to take possession of the islands of Cape Breton and St. John, and a squadron was appointed to protect Nova Scotia. Boscawen then returned to England with four ships of the line, and was thanked by Parliament for his further successful services. On 2nd February 1759 the King appointed him a member of the Privy Council.

After being at home only a few weeks Boscawen was again ordered to sea, this time as commander of a fleet consisting of 14 sail of the line and two frigates. A French fleet then at Toulon was to join the French Grand fleet at Brest, and the combined naval force was to cover an invasion of England. Boscawen was instructed to watch the reinforcements at Toulon and to prevent them from joining the main fleet at Brest, where Admiral Hawke with 25 ships was keeping watch. The task of cruising about off Toulon proved very tedious, and Boscawen used every endeavour to draw the French ships out into the open. Finally he ordered three of his ships of the line to sail up to the entrance of the harbour and try to destroy two enemy ships that lay moored there under cover of the shore batteries. The attempt was made, but the English ships received such a hot reception from the defending batteries that they were almost disabled, and eventually they were towed out of range of the batteries by boats from the other English ships.

Boscawen retired to Gibraltar to repair the damaged vessels, but he stationed one of his ships, the "*Gibraltar*," at the entrance to the Straits, and another, the "*Lyme*," off Malaga, to keep a lookout for the enemy. As anticipated, the French at Toulon took advantage of the withdrawal of the English fleet, and leaving harbour as soon as possible they steered for Brest. Boscawen learned of this move on the evening of 17th August, when the "*Gibraltar*" hastened in and reported that a French fleet of 14 ships of the line was in sight. The English fleet was hastily made ready for sea, and in less than two hours put out of the Bay in pursuit of the enemy. The chase lasted all night, and at daybreak only four of the enemy ships were in sight, and these were not caught up until after midday. A running fight ensued, and eventually one of the ships, the "*Ocean*," ran ashore in the Bay of Lagos, and the other three surrendered. Although many of the enemy ships escaped, the attack achieved its purpose of preventing a junction of the Toulon and Brest fleets. Boscawen returned to England where he received a great welcome, and as a reward for his services the King appointed him a General of the Marines.

In the Autumn of 1760 ill health compelled Boscawen to retire from public service. Shortly afterward he was attacked by typhoid fever, and died on 10th January, 1761, at his country home, Hatchlands Park, Surrey. He was interred among his ancestors in the parish church of St. Michael, Penkivel, Cornwall, where there is a monument to his memory.

Leather from Shark Skins—(*Cont. from page 359*)

when he recognises those aboard are helpless. But when he is in a corner and recognises you are his master, then he instantly gives up the struggle. True, he does eat human beings if they happen to come his way, and this applies also to other fish. I have examined the stomachs of hundreds of sharks, and though I have found in them the shells of turtles, empty meat tins, and other things, it is very rare indeed to find anything belonging to a human being."

A very simple method has been found for catching the monsters. They are taken in large gill nets specially woven of strong thread. A net extends nearly 500 ft. in length, and it is set some little distance off the shore, across the run of the fish. The small fish pass through the mesh, but the sharks are caught by their gills and, being unable to extricate themselves, become suffocated or drowned. Death follows quickly, and it is rarely that a shark lives fives minutes after it has been caught. As many as 415 sharks have been taken in a single net, the record being 1,062 from six nets. Care has to be taken in removing the catches from the net. If the fish is still alive, it is invariably so exhausted that a tap on the head from a club is sufficient to kill it; but the reflex action of the body of a dead shark is powerful enough to knock a man down.

New Milling Machine—(*Continued from page 335*)

moved along its supporting cross-rail in order to bring it into position to remove the five-thousandths of an inch of metal left on to allow for finishing. The castings are then removed from their fixtures and are bolted together, reaming of the bore for the shaft then completing the casing in readiness for assembly.

Thus, with the exception of the final reaming of the boring surfaces, the entire casing is machined on the planer-type milling machine from two rough castings, and the whole of this work is carried out without removing its two sections from the table of the machine.

This is only one example of the usefulness of this interesting machine, but there are many other intricate machining operations undertaken in modern workshops for which the Sellers planer is specially suitable.

Meccano model-builders who have a good assortment of parts at their disposal will find this machine a good subject for their attention, and from the description given here no difficulty should be experienced in building a successful model.

H.R.C. COMPETITION PAGE

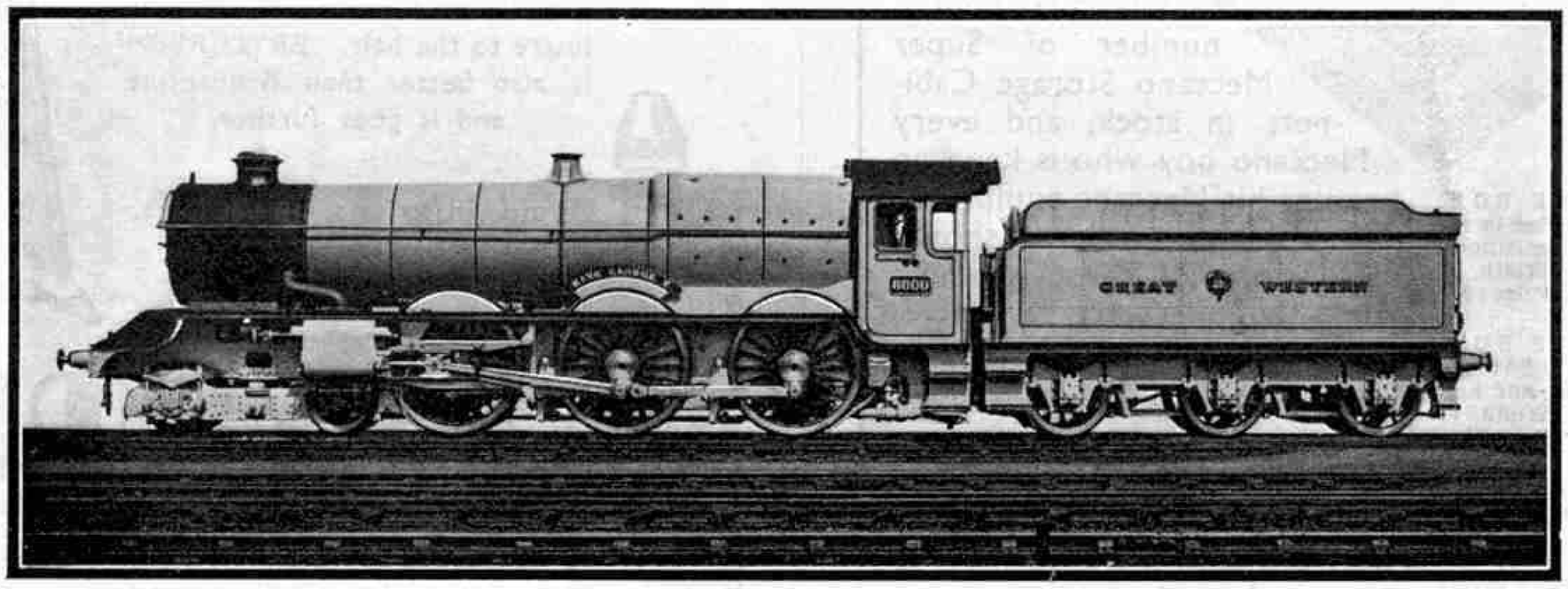
Competitions appearing on this page are open only to members of the Hornby Railway Company. Envelopes containing entries should have the title of the competition clearly written in the top left-hand corner and should be addressed to the Hornby Railway Company, Binns Road, Liverpool 13. The name, address and membership number of each competitor should appear in clear writing on every sheet of paper used.

LOCOMOTIVE PECULIARITIES CONTEST

The fascination of the steam locomotive, which continues unabated in spite of all the rival attractions of motor cars and aeroplanes, is due to a variety of causes. First of all there is its immense size and the impression it gives of enormous power. The electric locomotive hides its giant strength and therefore appears comparatively unimpressive; but the steam locomotive scorns false modesty of this kind, and by its exhaust when in motion proclaims its power far and wide.

The keen railway enthusiast appreciates to the full these outward features of the steam locomotive, but he is also interested in details of design and construction. He finds a great fascination in investigating the manner in which locomotives of various lines differ from one another in these details.

This month we announce a competition that will enable H.R.C. members to test their knowledge of locomotive details. We illustrate a G.W.R. "King," and competitors are required to state as many features as possible included in this locomotive, but not found as standard features of similar passenger locomotives owned by the other three British groups. For example, there is the domeless coned boiler. This has been a feature almost peculiar to G.W.R. construction for more than 25 years, and although found elsewhere is not a standard feature on corresponding engines of the other groups.



The contest will be divided as usual into two sections—Home and Overseas. Prizes of Hornby Train Goods, or Meccano products if preferred, to the value of 21/–, 15/–, 10/6 and 5/– respectively, will be awarded to the four competitors in each section whose lists are the most complete and accurate. In addition, a number of consolation prizes will be awarded to those boys whose entries are not sufficiently correct to qualify for one of the major awards, but whose general neatness recommends them for a consolation prize. Envelopes containing entries should be clearly marked in the top left-hand corner "*H.R.C. Loco Peculiarities*," and must be posted to reach Headquarters at Meccano Ltd., Binns Road, Liverpool 13, on or before 31st May. Overseas competitors should send their entries to arrive not later than 31st August.

It must be remembered that the omission of the membership number from an entry will cause it to be disqualified. This is an important condition to which competitors should pay special attention, as its neglect in the past has occasionally caused a promising entry to be disqualified.

Railway Photographic Contest

The majority of railway enthusiasts who possess cameras take every opportunity of photographing items of railway interest, but as a rule they do not deliberately set out to photograph a series of special pictures. In other words, snapshots are made of anything of railway interest that attracts attention, either because there is something unusual about it or merely because it makes a striking picture. The result is that H.R.C. members soon accumulate a considerable number of railway photographs of a thoroughly miscellaneous character, with no special type of subject predominating.

We therefore announce this month a "*Railway Photo Contest*" without restrictions of any kind as to subject or otherwise, in order to enable members to make use of some of their miscellaneous photographs. This wide scope will encourage beginners to make greater use of their cameras, and will enable any railway photograph to be entered with a chance of success.

There will be four prizes consisting of Hornby Railway material (or photographic goods, if preferred), to the value of 21/–, 15/–, 10/6 and 5/– respectively awarded to the senders of the four best entries in each section—Home and Overseas. Those who enter this competition may submit as many entries as they wish, but no competitor will be awarded more than one prize. Entries will be judged more on their railway interest than on their technical excellence, but in the event of a tie between any two photographs of equal railway interest the photographic merits of the prints will be the deciding factor.

The competitor's name and full address must be written on the back of each print submitted, together with his H.R.C. membership number—omission of which will result in disqualification—and a brief description of the scene of the photograph.

Envelopes containing entries should be marked "*H.R.C. Railway Photo Contest*" and posted to reach Headquarters at Meccano Ltd., Binns Road, Liverpool 13, not later than 31st May. Overseas closing date, 31st August.

COMPETITION RESULTS

HOME

February "Locomotive Problem."—First: D. J. Rogers (20769), Kingstown, Co. Dublin. Second: E. A. Taylor (25924), North Harrow. Third: R. Lynn (32449), Wisbech. Fourth: A. G. Rudd (26116), Bramhall, Nr. Stockport. Consolation Prizes: H. Pollitt (8000), Accrington; M. Mott (30870), Bury; H. Buckingham (23588), Leighton Buzzard; J. L. Makin (30933), Penwortham, Nr. Preston; J. Pedlow (20670), Belfast; C. J. Pittman (10217), Brixton, S.W.9; D. T. Howsley (24784), Matlock, Derbys.; K. Costain (5108), Bolton.

February "Railway Drawing Contest."—First: V. Kaile (17559), Mayford, Nr. Woking. Second: A. F. Poyser (11568), Gloucester. Third: L. Rimmer (9888), Liverpool 19. Fourth: R. V. Bentley (3003), Blackpool. Consolation Prizes: L. Martin (6922), Leicester; L. Tipler (11408), Tipton, Staffs.; H. J. Daymond (29343), Maghull; H. N. Marlow (33641), Sydenham, S.E.26; L. L. Luck (1685), Portsmouth; R. Couling (28701), Southall; C. A. Manship (29150), East Cosham, Hants.

OVERSEAS

November "Hidden Stations Contest."—First: E. A. Bunt (24651), Capetown, S. Africa. Second: R. Pascaud (29988), Chaumont, France. Third: D. J. White (9333), Dunedin, N.Z. Fourth: H. C. Key (24764), Calcutta, India.

November "Accessory Voting Contest."—First: R. Garcia (23445), Port-of-Spain, Trinidad, B.W.I. Second: A. Cramp (11438), Sydney, Australia. Third: R. J. Ranikhetvala (30850), Bombay, India. Fourth: L. S. Osborne (24478), Oakleigh, S.E.12, Australia.

Only a few left

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We have a limited number of Super Meccano Storage Cabinets in stock, and every Meccano boy who is keen on keeping his Meccano equipment "in apple-pie order" should obtain one of these cabinets while supplies are available.

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No. 2 STORAGE BOX. Finished as No. 1 Box and provided with lock and key. Length, 14½ ins. Width, 11 ins. Depth, 3¾ ins. Price 21/-

No. 3 STORAGE BOX. A perfect receptacle for Meccano parts. Finished similarly to the No. 1 and No. 2 boxes and provided with lock and key. Length, 20 ins. Width, 14 ins. Depth, 5½ ins. Price 30/-

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Avoid injurious substitutes.

Insist upon having

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LEMON ORANGE GRAPE FRUIT

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You will find Grape Fruit Squash excellent before breakfast—but all three are ideal drinks for any time and occasion. Ready for use by mixing with five parts plain or soda water.

Prices: Per large bottle, 2/-
Per full ½ bottle, 1/1

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TONGUE TWISTING

Mrs. Brown had given some pans to the travelling tinker to mend. A short time afterwards she went to see if he was doing them correctly.

"Are you copper-bottoming 'em?" she demanded.

"No, I'm aluminiuming 'em, mum," was the reply.

* * * *

"Hadn't you better go and tell your master?" said the motorist to the farmer's boy who stood looking at the load of hay upset in the lane by a collision.

"'E knows," replied the boy.

"Knows? How can he know?"

"'Cos 'e's under the 'ay."

* * * *

"Gentlemen," said the professor, "this is one of the most dangerous experiments known to science. The slightest mishap and the experimenter will be blown to atoms. I will now step into the next room while my assistant performs the experiment."

* * * *

First Charwoman: "'Ow d'yer like yer new neighbour, Mrs. 'Awkins?"

Second Charwoman: "Oh, she's all right, but she's 'aughty, and if there's one thing I 'ate it's 'aught!"

* * * *

"Bridget," called the mistress from upstairs, "I hope you turned the gas on as I told you?"

"Yes, ma'am," answered the new girl; "can't you smell it?"

* * * *

Teacher: "Your son spells atrociously!"

Pa: "Splendid! I couldn't spell it myself."

* * * *

Lady (to butcher): "I'll take a pound of these sausages. Are they British?"

Butcher: "Yes, ma'am, the bull-dog breed."

* * * *

"Waiter," shouted the diner, "there's a dead fly swimming in this soup."

"Impossible, sir," said the waiter, stiffly. "A dead fly can't swim."

* * * *

First Urchin: "My father's 'ad 'is photograph taken."

Second Urchin: "That's nothing. My father's 'ad 'is finger-prints took."

* * * *

Angler (at conclusion of story): "Yes, it was rather awkward getting it home. You see, I had to order a bogie timber wagon."

* * * *

A FAIR WARNING

"Before you get on, old man, I think it's only fair to warn you that I've got a dreadful cold."

* * * *

The porter was talking to a sympathetic traveller.

"Yes, sir," he said, "on the average I handle the luggage of 36 passengers a day. And what's more," he added confidentially, "if each of those passengers would increase my tip by one penny, my average daily takings would amount to three shillings!"

A TRIAL TRIP

An old woman asked the bus conductor not to start till she had reached the top of the stairs. When she reached the last step he called out: "Are you all right, madam?"

"No," was the reply, "I'm coming down again."

"Where do you want to go to, madam?"

"I'm not going anywhere to-day, but if it's fine I might go for a ride to-morrow, and I wanted to see if I could get up the steps all right."

* * * *

Brown: "That's a nice little place you've got. Why do you call it the Cloisters?"

Isaacs: "Vell, it's cloise to the cinema, cloise to the station, and cloise to the synagogue."

* * * *

WHERE HE WAS!

"Where am I?" asked the dazed man as he came round after being knocked down by a bus in a busy London street.

"'Ere you are, guv'nor," said a street hawker, who stood in the crowd, "map o' London, one penny."

* * * *

Musketry Instructor: "Now I've explained all the principles of sighting a rifle. What would you describe as a fine sight?"

Recruit: "Two dinners on one plate, sir."

* * * *

Traveller (to heavily loaded porter): "Oh, dear, I believe I hear the train going."

Porter: "No, Mum, that's only my 'eart breaking."

* * * *

City Visitor: "Which is correct, to speak of a sitting hen or a setting hen?"

Farmer: "Don't know, and don't care. What I like to know is, when a hen cackles has she laid or lied?"

* * * *

"How did you learn to walk the tight-rope? Did you pick it up?"

"Oh, no, it has to be taut!"

* * * *

"What kind of tyres do you prefer, balloon or high pressure?"

"I like balloons better, as a matter of fact."

"What kind of car have you?"

"I haven't any car; I'm a pedestrian."

* * * *

Office Manager (sarcastically): "I notice there were 35,000 people present on the afternoon that your grandmother was buried."

Office Boy (rising to the occasion): "I couldn't swear to that, sir, but grandma was always very popular!"

* * * *

The teacher intended to spend the lesson in a talk on the advantages of peace and disarmament.

"How many of you boys object to war?" he began.

Up went Billie Slack's hand.

"Why, Billie?" asked the teacher.

"Because wars make history," said Billy.

THE DIFFERENCE!

"In your paper this morning you described my speech last night as the 'insane drivellings of a played-out politician.'"

"What! My dear sir, I am truly sorry if it appeared that way in our paper. The word I used was 'inane'."

* * * *

The express was about to start when an old lady ran on to the platform in breathless haste. The guard pounced upon her, fairly lifted her into a carriage, and as he slammed the door the train moved out of the station.

The first stopping-place was 60 miles down the line, and when the train arrived the guard saw the old lady getting out of her carriage in a state of indignation.

"You almost missed it, ma'am," he said.

"Missed it!" burst out the old lady. "I only wanted to post a letter in the late-fee box in the train!"

* * * *

Father (to small daughter): "How did you succeed in your examination?"

Small daughter (hesitating): "I don't know, father."

Father: "How is that?"

Small daughter: "Well, father, the teacher told all those who had passed to-day, and to-morrow she's going to tell those who have failed."

* * * *

"It says in this paper that a scientist has discovered that singing warms the blood."

"He's right, I've heard singing that has made my blood boil."

* * * *

The question of their sons' professions was being discussed.

"Well," said one, "and what have you thought of putting your boy to now that he's finished school?"

"I'm going to try him at law," said the other. "He's naturally argumentative, and bent on getting mixed up with other people's troubles, and he might just as well get paid for it."

* * * *

The doctor gazed critically at his patient. "Did you take my advice and sleep with all the windows open?" he asked.

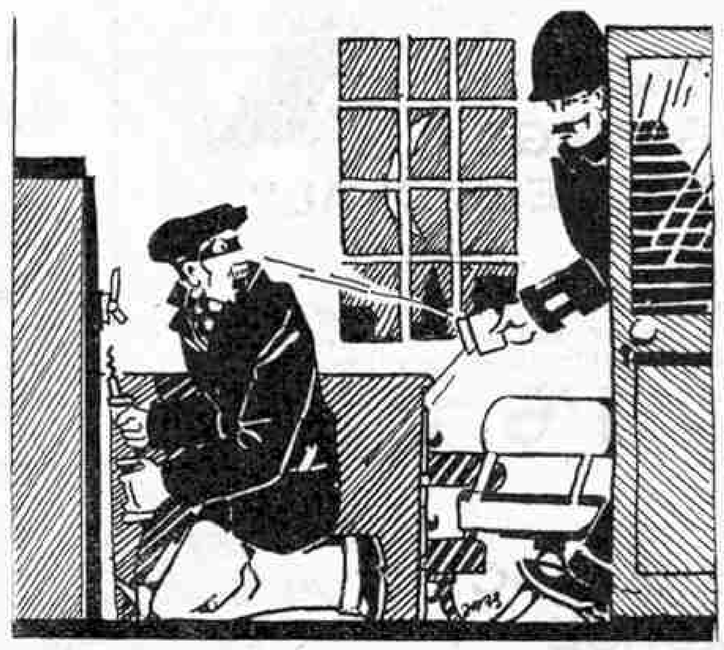
"I did, doctor," the patient murmured.

"Good," said the medical man. "And I suppose you've pretty well lost that cold you had?"

"No, doctor," said the other; "only my best coat and my watch and chain."

* * * *

A "SAFE" DIAGNOSIS



"You are working too hard," said the policeman to a man who was drilling a hole in a safe, at two o'clock in the morning.

"What's that?" asked the burglar.

"I say you need arrest," replied the policeman.

* * * *

Big Game Hunter: "Then I rushed in and cut off the lion's tail."

One of the Audience: "Why didn't you cut off his head?"

Big Game Hunter: "Somebody had done that an hour before I got there."

100% EFFICIENCY!

The Warneford "Moth" Flies 700 feet at 15 m.p.h. and Rises from Ground

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WORLD'S RECORD BREAKERS

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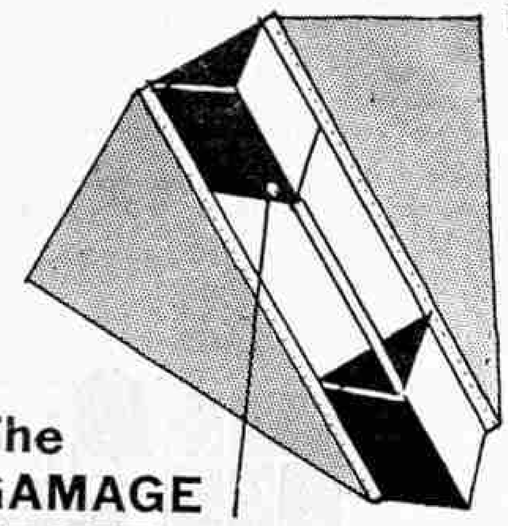


The GAMAGE "PROFESSIONAL" KITE

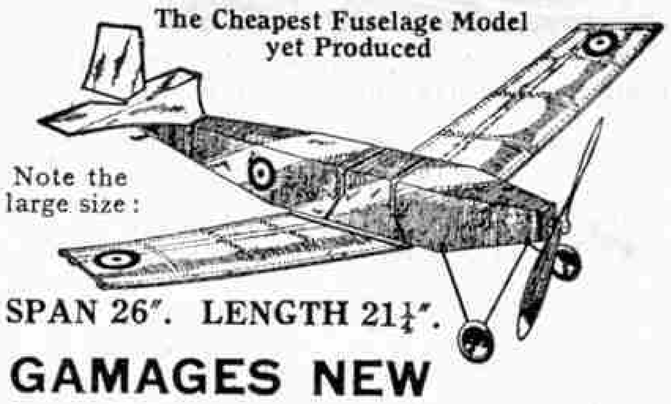
An ideal Kite for the younger boy. Very easy to fly and made in attractive colours. Note these very low prices.

Size 21". Price **1/6** Post 3d.

Size 28". Price **2/6** Post 4d.

ELECTRIC MORSE SETS

Owing to unforseen circumstances details of these sets are unavoidably held over for the time being.



SPAN 26". LENGTH 21¼".

GAMAGES NEW FUSELAGE MONOPLANE

Scientifically constructed and designed. Rises from ground after short run, and is perfectly stable in flight—even in strong winds. Fuselage covered with silk and doped finished. Coloured aluminium and light blue. Main plane and tail unit covered proofed silk. Weight only 3¼ oz. Span, 26". Length, 21¼". Will fly for over 30 seconds. Speed 14½ m.p.h. Price **10/6** Post free.

Don't Miss Gamages "Skybirds" Display

Mr. R. H. GEHLCKEN

Winner of the Senior "All-In" Silver Cup, is in attendance with all the latest models and accessories.

INEXPENSIVE YACHT

As illustrated. These model yachts represent excellent value for money. They are strongly made and will put up a really good performance on the water. Length, 12". Price **5/6** Post 6d.

MODEL SEARCHLIGHT

A fine new model that will throw a beam of light 40 feet in the air. Just like the real thing. Strongly made and finished in black. Replaceable battery fits in base—out of sight. Dimensions: Height to top of light, 4½". Size of base, 4"×3". Diameter of lens, 2". Price complete with battery **3/9** Post 6d.

MODEL ELECTRIC SIGNAL

A three-light signal complete with battery in base. Flashes red, yellow and green lights by means of an ingenious switch. Every model railway owner should have a set of these signals. Strongly made and finished in black. Height, 7½" Base, 2¾" diameter. Price with battery **3/6** Post 6d.

The "DIANA" AIR GUN

No. 1 Muzzle Loader. A fine gun at moderate price. It will give you heaps of good sport. Price **4/9** Post 9d.

Slugs, 9d. 1,000.
Darts, 4½d. dozen.

Foreign

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Competition Corner

A NEW DOUBLET CONTEST

Many years ago the Doublet Word puzzle enjoyed almost as great a popularity as that accorded to the crossword puzzle to-day. It was invented by Lewis Carroll, the author of "*Alice in Wonderland*," to amuse his very large circle of friends. Many of these friends complained that the round of their social life provided little mental recreation and time hung heavily on their hands in consequence. Carroll's friends received his puzzle with great enthusiasm, and he was persuaded to introduce it to the public, with whom it "caught on" immediately and became quite a rage.

For the benefit of new readers, it must be explained that the Doublet consists of two given words, each containing the same number of letters. The problem is to change one word to the other by placing connecting words between. The connecting words are known as links, and each may differ from the preceding link by the alteration of one letter only. It is obvious, of course, that only words of the same length as those comprising the Doublet may be used.

As illustrations we give the following examples:

Place *WIND* in *WEST*

WIND-wend-went-*WEST*

Run *TRAIN* on *TRACK*

TRAIN-trait-tract-*TRACK*

The set of Doublets that are to be solved in this contest contain several that are considerably more involved than any that we have used in previous contests. Nevertheless, our experience of Meccano boys leads us to anticipate that they will not find serious difficulty in working out the solutions. It is an important point to remember that the first solution is not necessarily the shortest. Competitors should go over their solutions carefully in search of "short cuts" that will eliminate unnecessary links.

This excellent painting of the Bristol University Buildings and Tower secured first prize in the A Section of the Public Buildings Drawing Contest for L. Hope, of Weston-super-Mare.

It should be noted in making the links that only English words appearing in a standard dictionary may be used. Proper nouns, names of persons, places, etc.—are not permitted.

The Doublets to be solved are as follows:—

Bowl	BUMPER	at	WICKET
Paint	SKY		RED
Drive	SCREW	into	BOARD
Fix	KITE	to	CORD
Mix	PASTE	with	FLOUR
Pour	WATER	into	BASIN
Light	BLAZE	with	GORSE
Free	LAWN	from	WEED
Fit	MAST	into	SHIP
Omit	MEAT	from	DIET

In judging the entries, the ten doublets will be considered as one contest, and prizes of Meccano or Hornby Train goods to the value of 21/–, 15/–, 10/6 and 5/– respectively will be awarded to the senders of the four solutions showing the lowest total of links used throughout. In addition there will be a number of consolation prizes for the entries next in order of merit. In the event of a tie for any of the prizes, preference will be given to the entry having the neatest or most novel presentation.

It will be observed that the combination of the 10 doublets for judging purposes will ensure that a brilliant solution of one doublet will carry its full weight by offsetting, partially, at least, failure to secure the shortest chain in another case.

Entries should be addressed to "Doublets, Meccano Magazine, Binns Road, Liverpool 13," and sent to reach this office not later than 31st May. There will be a duplicate set of prizes reserved for entries from Overseas readers, whose entries must reach us not later than 31st August.

Entries must be written on one side of the paper only and each sheet of paper used must bear the competitor's name and address. The total number of links used must be noted at the head of the first sheet.

May Photographic Contest

As we announced in our April issue, our monthly photographic contests are open for photographs of any subject. The only restrictions are that each print must bear a title and that the exposure shall have been made by the competitor.

The entries will be divided into two sections, A for those from readers aged 16 and over, B for those under 16, and in each section there will be prizes of photographic materials, or Meccano products, to the value of 21/– and 10/6 for the best and second best entry respectively. A duplicate set of prizes will be reserved for Overseas competitors.

Entries to this month's contest must be addressed "May Photo Contest, Meccano Magazine, Liverpool 13," and must reach this office not later than 31st May. Overseas closing date, 31st August.

Unsuccessful entries will be returned if a stamped cover is sent for the purpose.

COMPETITION RESULTS

December Stamp Contest.—1. G. A. Batty (Gt. Crosby); 2. W. P. Short (Taunton); 3. C. Dinsdale (Grantham); 4. H. Harrison (Milnathort). Consolation Prizes: L. Goldsmith (Lowestoft); P. P. Marlow (Yeovil); J. B. Pinnock (Bedford).

January Drawing Contest.—First Prizes: Section A, L. Hope (Weston-super-Mare); Section B, L. Ward (Mansfield). Second Prizes: Section A, D. Conington (Godmanchester); Section B, A. N. Parry (Wallasey). Consolation Prizes: D. G. Adey (Ilford); B. W. Benson (Rock Ferry); G. Brown (Pitlochry); K. Costain (Bolton); A. Holden (Luton); R. Greig (Birmingham); H. H. Reynard (Lewisham, S.E.13); T. M. Roberts (Anfield); C. Smith (Roehampton, S.W.15); H. B. Ward (Great Crosby).

Stamp Voting Contest.—1. B. Chinneck (Portsmouth). 2. G. Kingsmill (New Barnet). 3. K. Werrell (South Kensington, S.W.10). 4. G. Seymour (Bisley). Consolation Prizes: H. J. C. Gower (Rye); L. Huddy (Watford); Wm. L. Maclean (Stornoway); J. B. Murray (Barrow-in-Furness); M. Peters (Chichester); E. J. Pryor (Bedford); E. J. Wiltshire (Penygraig).

Competition Ideas.—1. Miss M. Whitaker (Hornsea); 2. F. Merriman (Oxford); 3. A. E. Smith (Brighton); 4. T. K. Dowty (Whaddon). Consolation Prizes: D. U. Cohen (Olton); J. Newton (Hessle); D. Norman (Colchester); R. C. Storrar (Letham Ladybank); F. R. Taylor (Oxford); L. Ware (London, S.W.11 W. Whitaker (Hornsea).

OVERSEAS

October Drawing Contest.—First Prizes: Section A, S. D. Kurlawala (Bombay); Section B, R. J. Dickinson (Dunedin, N.Z.). Second Prizes: Section A, R. Wepener (Cape Town); Section B, F. G. Eagle (Bombay).

Doublets.—1. S. M. Bemstein (Cape Town); 2. M. Buist (Wellington); 3. N. F. Keith (Sydney, N.S.W.); 4. E. Harper (Cambridge, S. Africa). Consolation Prizes: R. Burbery (Lyttelton, N.Z.); E. R. Fusslein (Zululand); D. Grieve (Bloemfontein); G. Harrison (Victoria, B.C.); J. W. Saunders (St. Lambert, Que.); E. Worthington (Vancouver).

Tree Figures.—1. F. Van Bulck (Brussels); 2. F. Soar (Vancouver, B.C.); 3. S. Smith (Auckland); 4. M. S. Ayson (Invercargill, N.Z.). Consolation Prizes: G. Crawford (Verdun, Que.); S. F. Desai (Bombay); R. B. Greene (Montreal); K. J. Orams (Blenheim, N.Z.); J. G. Wulfsohn (Johannesburg).

Advertisement Letter Contest.—1. J. Hers (Johannesburg); 2. L. Brien (Thames, N.Z.); 3. J. A. Rodriguez (Montreal); 4. S. Samson (Poona-Camp). Consolation Prizes: G. Lyons (Penang, S.S.); D. W. Johnston (Wellington, N.Z.).

November Drawing Contest.—First Prizes: Section A, J. S. de Conti Manduca (Malta); Section B, A. C. Davies (Victoria, Australia). Second Prizes: Section A, S. D. Kurlawala (Bombay); Section B, R. Cain (Durban). Consolation Prizes: S. N. P. Dolittle (Auckland, N.Z.); C. Moyle (Johannesburg); M. T. Robotham (Sydney); B. D. H. J. Silva (Colombo); J. T. Smythies (Vancouver).

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50 Austria ...	6d.	50 Russia ...	1/3
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50 Guatemala ...	3/–	5 Syria ...	3d.
50 Germany ...	6d.	5 Palestine ...	2d.
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50 Poland ...	1/–	10 China ...	2d.
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*4 Fiume, 1922. 20c. to 1 lire. Large pictorials	5d.		
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14 S. Africa, 1926-31. Pictorials (Cat. 2/2) ...	5d.		
*4 Mozambique, 1894-04. Pictorials (Cat. 8/3)	5d.		
1 Rhodesia, 1897. Large 8d. pictorial (Cat. 4/6)	3d.		
*14 Antioquia, 1899. Complete set (Cat. 2/11)	6d.		
9 Roumania Schoolboy King. Complete set	6d.		
*1 Iceland Triangular, 1930. Air Mail ...	3d.		
5 Liberia Triangular, 1921. Snake type ...	1/6		
5 India, 1931. New Delhi commemorative ...	9d.		
4 Belgian Congo, 1920. Large Air Mail ...	1/6		
*1 Sudan, 1932. 3 mils. Air. Monoplane pict.	3d.		
1 Latvia Triangular, 1921. Air Mail (Cat. 1/6)	4d.		
*1 Liberia Triangular, 1919. 10c. (Cat. 1/6)	3d.		
2 Mexico, 1929. Air Mails. Monoplane pictorials	5d.		
2 Syria, 1931. Large Air Mail pictorials ...	3d.		
*1 Spain Triangular, 1930. 25c. Columbus issue	3d.		
25 Holland ... 3d.		100 British Colonials ...	9d.
25 Air Mails... 6d.		500 Different Stamps ...	1/6
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Every stamp in this unique packet **has a lion on it.** A fine Set of **BELGIAN** (lions), Set of **Bavaria** including pictorial officials, Set of **ESTHONIA,** Set of **NEW ZEALAND** (Victory pictorials), Set of **14 Norway and Sweden,** including officials, Set of **Denmark** (with 20 lions), **PERSIA** (lion with sword), **CZECHO-SLOVAKIA,** Bulgaria, **SCHLESWIG,** Plebiscite unused, Set of **16 FINLAND,** new issue, etc. (usually sold at **1/4**), and a fine pictorial **SORUTH** surcharged **SARKAR.** Price **5d.,** postage **1½d.** extra. Purchasers of this packet asking for sheets will be presented with a beautiful Set of **DANZIG** (including high values to 500,000M. **FREE**). (20 lions making a total of 120 lions with the packet), this Set alone usually sells at **10d.** A free Set of stamps will also be given to all who send addresses of stamp collecting friends. **H. C. WATKINS (M.M. Dept.), GRANVILLE ROAD, BARNET.**

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SET OF 8 SHIP AND AIR PICTORIALS (Fine large stamps showing Flagship of Columbus).

This great set of **8 SPANISH PICTORIALS,** unused, showing Columbus's flagship, the **SANTA MARIA,** both fore and aft views, also **AIR STAMPS** (Monastery of La Rabida), 50 other fine stamps, including many Colonials, unused high values, **BRAZIL, TURKEY,** good sets, etc. **FREE TO APPROVAL APPLICANTS WHO SEND 2d. FOR POSTAGE.**

J. BURTON, 31, ONSLOW ROAD, LIVERPOOL 6.

50 DIFF. STAMPS

EQUIPPING THE STAMP COLLECTOR—(IV)

In this article we continue the explanations of stamp terms that were commenced in the April "*M.M.*" It should be understood, however, that in articles of this nature we cannot cover the whole field, and must confine ourselves to the commoner expressions. A complete glossary of stamp collecting terms would fill a volume of respectable size.

A tête bêche pair from South Africa's 1913/21 issue.

In the course of an average year some 1,500 to 1,600 new stamps are issued, and a considerable proportion of these are commemorative stamps, issued to celebrate an event or anniversary of some importance. Certain countries have curious views on the degree of importance necessary to justify a special issue of stamps, and in quite a number of cases recently there has been more than a suspicion that the issue's principal object was to raise funds for depleted treasuries by the sale of the stamps to collectors. A "charity" stamp may also be a commemorative stamp, but the essential difference is that the charity issue is sold at more than its face value, the extra charge, known as the "premium," being devoted to charitable objects.

"Varieties" is another self-explained term. It is exceedingly difficult to maintain absolute uniformity of production for a stamp issued in large quantities throughout a long period. Slight differences may arise in the colour of the printing ink or in the perforation; there may be flaws in the printing or in the printing plate. Stamps exhibiting such differences are "varieties" of the original stamp.

Errors are rather different from "varieties" in that they arise from definite mistakes in the preparation of the stamp. A perforating machine may miss an entire sheet of stamps or part of it. The stamp may be printed from two plates, and inadvertently one may be inverted in relation to the other, creating what is known as an "inverted centre" or an "inverted frame."

A story is told of an American boy who entered a stamp dealer's shop and laid a stamp on the counter, saying: "Please, mister, there's something the matter with this stamp. I bought it here and I'd like to exchange it for something else." Ever willing to oblige, the dealer passed over one of his stock books with the remark: "Choose anything you like in there." The choice made, the youngster bolted for the door, pausing only to howl derisively: "Yah! Done you! I didn't get it here at all!"

The laugh was with the dealer, however. There was something wrong with the stamp, for it was a specimen of the extremely rare "inverted centre" error of the 2c. Buffalo Exhibition series of 1901. Unused specimens of this stamp are catalogued to-day at £500!

Inspection of the pair of South African stamps illustrated here will show how this inversion may occur. The centre plate bearing King George's portrait is perfectly symmetrical, and would fit perfectly if inverted when placed within the plate that prints the frame design.

We reproduce also a very interesting pair of 1/– stamps from Jamaica's 1860 issue showing an error that has come to be known as the "dollar variety." Examination of the right-hand stamp shows the $ sign in place of the *S* in shilling. This is one of the many rare items from the collection of Jamaican stamps formed by the late Mr. L. O. Trivett, that is to be auctioned on the tenth of this month by Messrs. Plumridge & Company, of Chancery Lane, W.C.2, to whom we are indebted for permission to reproduce this very interesting piece.

This pair from the Jamaica 1860/63 issue exhibits the so-called "dollar variety." Note the $ sign in place of the S in shilling in the right-hand stamp.

The South African stamps shown here illustrate more than the simplicity of inversion of a centre plate. It will be noticed that one stamp is completely inverted in relation to the other. It is, in fact, a *tête bêche* error. Sheets of stamps are usually printed from plates prepared from a set of stereos made from the original engraving for the stamp. The *tête bêche* error occurs when one of these small stereos is inverted in relation to the rest and the stamp is printed upside down. To show the *tête bêche* error it is necessary of course to have it in pair with another stamp.

Since the introduction of stamp booklets, *tête bêche* varieties have become increasingly common. The special requirements of booklet printing make it necessary to print some of the pages upside down. When, as occasionally happens, those pages are sold before making up, *tête bêche* pairs are provided.

The young collector need not worry himself concerning forgeries and fakes. Such things exist, but "faking" stamps is an expensive matter, and only profitable when undertaken among old and valuable issues. "Reprints" of early issues are in a different category, but usually they are produced from the original printing plates, and are genuinely intended to provide collectors with specimens of stamps that are no longer available in original form. Such reprints can be distinguished from original issues by marked variations in colour, paper, perforation, watermark or gum. Financial restrictions compel most boys to limit their collecting to everyday stamps, and if they make a point of steering clear of "bargains" offered from little known sources, they need not fear the swindler.

A highly magnified section of the border of a "penny red" showing the plate number.

Earlier in this article reference was made to printing plates, and the well-known term "Plate number" comes to mind immediately. This term must not be confused with the private markings that stamp printers commonly place in the margins of stamp sheets to identify the plate from which the sheet was printed. The "plate numbers" for which collectors search are those embodied in the actual design of the early issues of Queen Victoria's reign, notably the "penny reds." *Continued on page 396*

A strip showing the control number. Note also the co-extensive jubilee line.

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Over 60 Different Stamps, **Brazil** (Aeroplane), **Morocco** (Biplane), **Roumania Aviation Fund** (Monoplane over Mountains). Over 30 Obsolete High Value Stamps, and a **Complete Set of Airmails** issued in 1919. Also **The Piccard Commemorative** (see illustration), which will soon be scarce. Included also are **Zoo** and Commemorative Stamps, **Maps**, Sowers, Reapers and Blacksmiths. **ALL FREE !** Just enclose 2d. postage requesting Approvals.

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was the British 1840 Penny Black. Against a P.O. 1/9 we will send you a genuine postally-used copy of this interesting stamp (cat. 6/–) ; for a further 5/– you may have a copy of its companion stamp, the 1840 2d. Blue (cat. 20/–). Another "classic" which every Collector should have is the **Cape of Good Hope** 4d. blue **Triangular** (cat. 15/–), and a nice copy will be supplied at 5/–. Superb approvals of any country against satisfactory English references or a deposit. **Full Lists Free.**

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for Bargain Packets every month. This month I offer the following :—

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No. 2. 500 Mixed Stamps, unpicked. Plenty of fun sorting these ... ... **6d.**
No. 3. 100 Stamps from my Office Mixture. On paper, as received. Contains high values **1/–**
Postage extra.

W. A. JONES, 39, NEVILLE ROAD, CROYDON.

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This gift will prove to be the **Sensation of 1933 !** There are fine stamps showing **Sailing Vessels, Native Boats, Windjammers, Liners, Monoplanes,** and **Biplanes.** There are also 30 all different, used and mint, Pictorials. British Colonials, Commemoratives. Finally there is **a new Bechuanaland Pictorial !** This amazing gift **is FREE** to **Genuine Applicants** for our Approvals who send **2d.** postage. Obviously **this is the Offer Supreme.** Write at once !

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This magnificent parcel contains **506 Unsorted Foreign Stamps,** many scarce, including **Discovery of New World by Columbus in 1492,** old issue Cuba, obsolete **Chinese (Train and Boat),** beautiful Jugo-Slavia, picturesque New Zealand, Ukraine (General Rodzirka's Army), Ceylonese, etc. All fine genuine stamps and **No Mint Germans.** Just send 2d. for postage and request our famous-extra-large-Discount Approval Sheets. (Abroad 6d. P.O.)

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of requests for my 4 a 1d. selections arrive by every post. Have you written for one yet ? Just the thing to occupy a rainy day.

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HENRY TURNER,
110, Barnett Road, Preston, Brighton, Sussex.

Stamp Collecting—(*Continued from page 395*)

In these the plate number was noted unobtrusively in the wavy border lines on each of the two sides of the stamp, as indicated in our illustration.

The presence of printers' private plate markings is not always apparent, although it is essential to facilitate identification of the plates from which the stamps were printed, in case of complaint. Some printers use heiroglyphics that convey nothing to the uninitiated, and indeed pass unnoticed by the majority of people. Complete histories may be concealed in small dots in the margins, under or alongside particular stamps, or in nicks in the "jubilee line."

The "jubilee line" is the heavy border line running around the complete sheet, parallel with the edges of the designs of the outside stamps ; and its name is derived from its first appearance on the Queen Victoria Jubilee stamps of 1877. It is produced by a bar of plain type rule placed around the edges of the printing plate for the purpose of protecting the plates by taking the shock of the inking rollers and lifting them to the level of the plate. Otherwise the shock would have to be taken by the printing plate, with the result that the edge would wear more quickly than the general surface. A line running around the sheet without a break, or broken only at the corners, is known as "continuous" ; but when it is broken into short lengths equal to the length of the edge of the adjacent stamps, it is known as "co-extensive."

The large numbers and letters found in the margins of sheets of British stamps are "control" numbers, commonly known as "controls," placed there for accountancy purposes. The figures of the combinations refer to the year of issue. "Controls" first appeared in 1884, and were used on the ½d. and 1d. values only up to the King George issues, when they were applied to all values up to 1/–.

100 DIFFERENT STAMPS FREE. Send for ½d. approvals.—Cox, 21, Dennis Mansions, Westcliff.

QUALITY NOT QUANTITY. 40 diff. Brit. Cols., 7d. post free.—Lucas, 60, Park Street, Bristol.

Stamps ! Packet 500 on approval. Pick any at ½d. each.—Wyk, 576, Chester Road, Manchester.

Three Caymans Centenary Free to genuine approval applicants.—Sanders, Newlands Ave., Southampton.

KING'S HEADS, Colonial and Foreign Duplicates for disposal. One Farthing per stamp. Send postcard for trial.–Philatelist, 32, Josephine Avenue, Brixton, S.W.2

PICTORIALS, King's Heads—Colonial or Foreign—one farthing upwards. Wonderful value. Send for selection.—Jal, 246, Dollis Hill Lane, London, N.W.2.

NOT A FREE GIFT. Send me 4d., ask for selection from 4 a 1d. (30 for 6d.), and I will send you new Pictorial Falkland, Papua, Cayman Centy., New Guinea (Air), Manchukuo, Trans-Jordan, Angola, Monaco, and 25 different Colonial and Foreign. Without Approvals, 6d.—J. R. Morris, 9, Audley Road, Folkstone, Kent.

SMALL ADVERTS.

1/6 per line (average 7 words to the line)

"MAKE YOUR OWN" Concentrates in 2d. Packets. Lacquers, Stains, Varnish, Polish, Colours, Inks, etc. List.—R.P.M. Co., Old Place Works, Goring-by-Sea.

BIRDS' EGGS AND BUTTERFLIES ! Send ½d. stamp for lists.—Forbes, Clutton, Chester.

Patents for Inventions, Trade Marks: "Advice Handbooks" and Cons. free. B. T. King, Regd. Patent Agent, 146a, Qn. Victoria St., London, E.C.4. 45 years' refs.

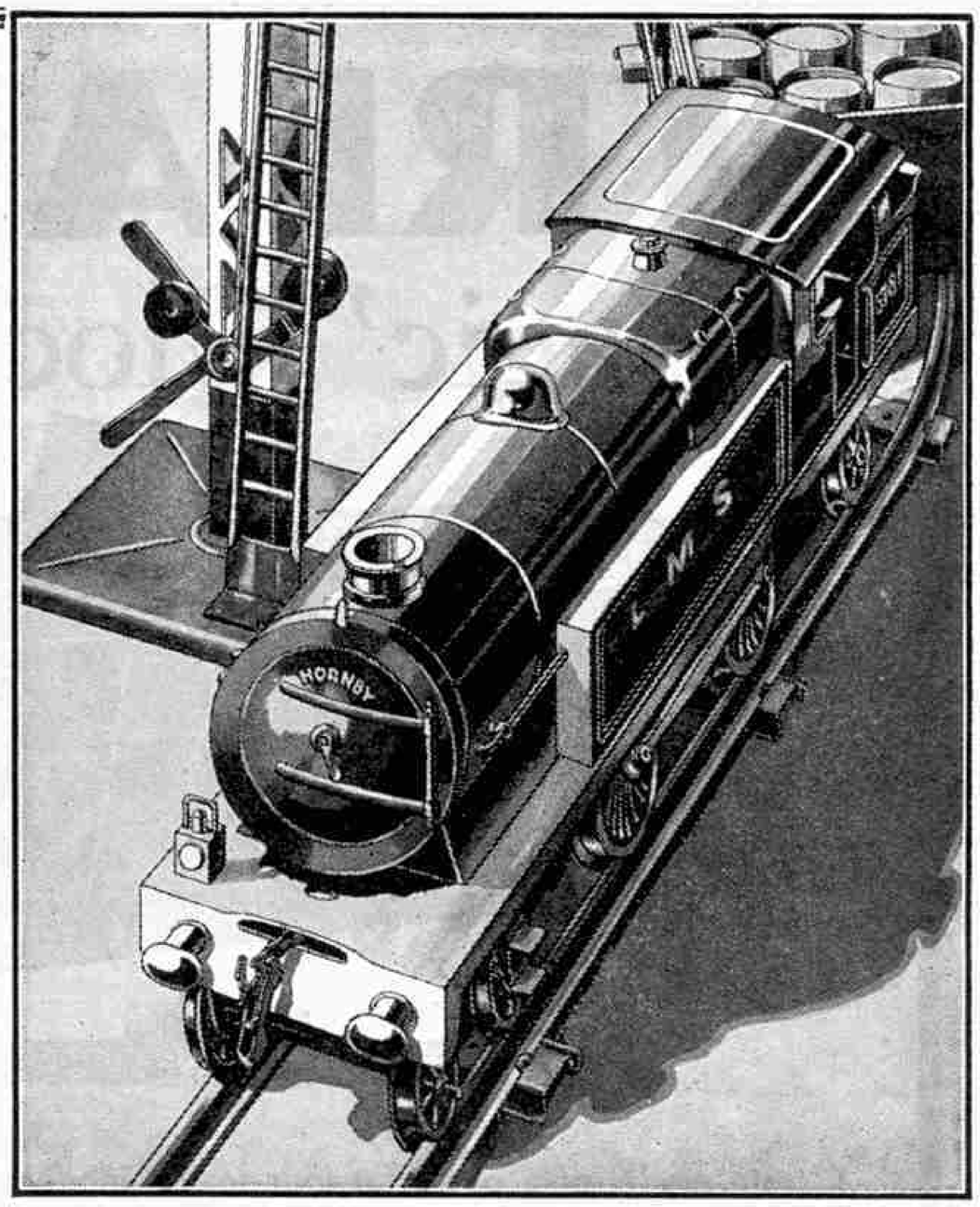
CINEMATOGRAPHS British Made from 37/6
CINEMATOGRAPH FILMS
from 5/– per 1,000 ft. Standard size only. Write for our Catalogue, post free, or send 1/– for sample length of Film and Catalogue.
Filmeries Co., 57, Lancaster Rd., Leytonstone, E.11.

THE "NEW ISSUE PACKET" FREE

This wonderful packet will be given **FREE** to all who apply for my famous Approval Sheets and enclose 1½d. postage. It contains **FINE PICTORIAL GABOON** (just issued). **NEW ISSUE ANDORRA,** a fine set of newly issued **CANADA,** including the **OTTAWA** Conference stamp, **U.S.A.** Bi-centenary of Washington, 1932 ; set of **UNION OF S. AFRICA,** pictorials, including re-issue of 2d., with war memorial added ; new issue of **STRAITS** and **MALAY,** 5c. brown ; a **FINE ICELAND** pictorial (see illustration) ; **RUANDA-URUNDI,** new pictorial ; **TURKEY,** new head issue, etc. 50 Stamps in all. Have you had my 70-page illustrated booklet, price 1d. ? Senders of stamp collectors' names receive an extra set free.

H. C. WATKINS, "M" DEPT., GRANVILLE ROAD, BARNET.

New Hornby Locomotives for old!



You have probably been using a Hornby Locomotive for some years and would like to own one of the fine new models that now figure in the Hornby Catalogues. The object of the new Hornby Locomotive Part Exchange Scheme is to help you to do this.

First of all, carefully study the latest Hornby Train Catalogue, and select the new up-to-date Hornby Locomotive you want; then carefully pack up your old Hornby Locomotive and post it to us, enclosing your order for the new one and the necessary remittance. You can easily ascertain how much to send by deducting the part exchange allowance indicated in the accompanying list from the price of the new Locomotive, and adding 1/– for postage on the new model you purchase.

If you prefer to do so, you can effect the exchange through your dealer, who will be very pleased to give you all the information you require.

The allowance that will be made for your old Locomotive is shown in the list of Part Exchange allowances for Hornby Locomotives given on this page. Please note that the catalogue price of the new Hornby Locomotive you purchase *must not be less than double the Part Exchange allowance made for your old Locomotive.*

No matter what the age or condition of your old Locomotive, you can exchange it under our "Part Exchange" plan. It is important to note that we cannot accept more than one old Locomotive in exchange for a new Locomotive.

If you decide to send your old Locomotive to us address your parcel to "Special Service Department, Meccano Limited, Binns Road, Liverpool 13," and be sure to enclose with it your own name and address written in plain characters.

What you have to do

Here is an example of how the plan works. Assuming you have a No. 1 Tank Locomotive that you wish to exchange, you see from the list that its exchange value is 6/3. You then look at the Hornby Train catalogue and choose one of the new Locomotives, the cost of which is not less than 12/6 (or, in other words, not less than double the Part Exchange allowance we make for your No. 1 Tank Locomotive).

You decide, say, to have a No. 2 Special Tank, the price of which is 25/–. Pack up your old No. 1 Tank and deduct 6/3 from 25/– (the price of the new No. 2 Special Tank) enclose a remittance for 18/9 plus 1/– carriage on the new Locomotive—19/9 in all. Send the Locomotive and the remittance to Meccano Limited, Liverpool 13.

Alternatively, you can take your old No. 1 Tank Locomotive to your dealer with a remittance for 18/9, and he will give you the new No. 2 Special Tank Locomotive that you require.

Part Exchange Allowances for Hornby Locomotives

CURRENT TYPES	
MO Locomotive	1/4
M1/2 Locomotive	2/3
M3 Tank Locomotive	3/9
No. O Locomotive	5/3
No. 1 Tank Locomotive	6/3
No. 1 Locomotive	6/3
LEC 1 Locomotive (Swiss Type)	7/6
No. 1 Special Locomotive	8/3
No. 1 Special Tank Locomotive	8/3
LST M3/20 Tank Locomotive (20-volt)	11/3
No. 2 Special Locomotive	11/3
No. 2 Special Tank Locomotive	11/3
No. 1 Electric Tank Locomotive, Permanent Magnet	12/6
LST 1/20 Tank Locomotive (20-volt)	12/6
LE 1/20 Locomotive (Swiss Type), 20-volt	13/3
LE 2/20 Locomotive (20-volt)	16/6
No. 2 Electric Tank Locomotive	18/9
No. 3E Locomotive	18/9
No. 3E Riviera "Blue" Locomotive	18/9
No. 3C Locomotive	13/9
No. 3C Riviera "Blue" Locomotive	13/9
Metropolitan C Locomotive	11/3
Metropolitan L.V. Locomotive	20/–
OBSOLETE TYPES	
M2930 Locomotive	1/–
George V Locomotive (These models were identical)	3/3
No. OO Locomotive (These models were identical)	3/3
M3 Locomotive	4/3
Zulu Locomotive	5/3
Zulu Tank Locomotive	6/3
No. 2 Locomotive	10/–
No. 2 Tank Locomotive	11/3
No. 1 Locomotive, fitted for Hornby Control	7/6
No. 1 Tank Locomotive, fitted for Hornby Control	7/6
No. 2 Locomotive, fitted for Hornby Control	11/3
No. 2 Tank Locomotive, fitted for Hornby Control	12/6
Metropolitan H.V. Locomotive	20/–

HORNBY TRAINS

MECCANO LTD. — SPECIAL SERVICE DEPT. — BINNS ROAD — LIVERPOOL 13

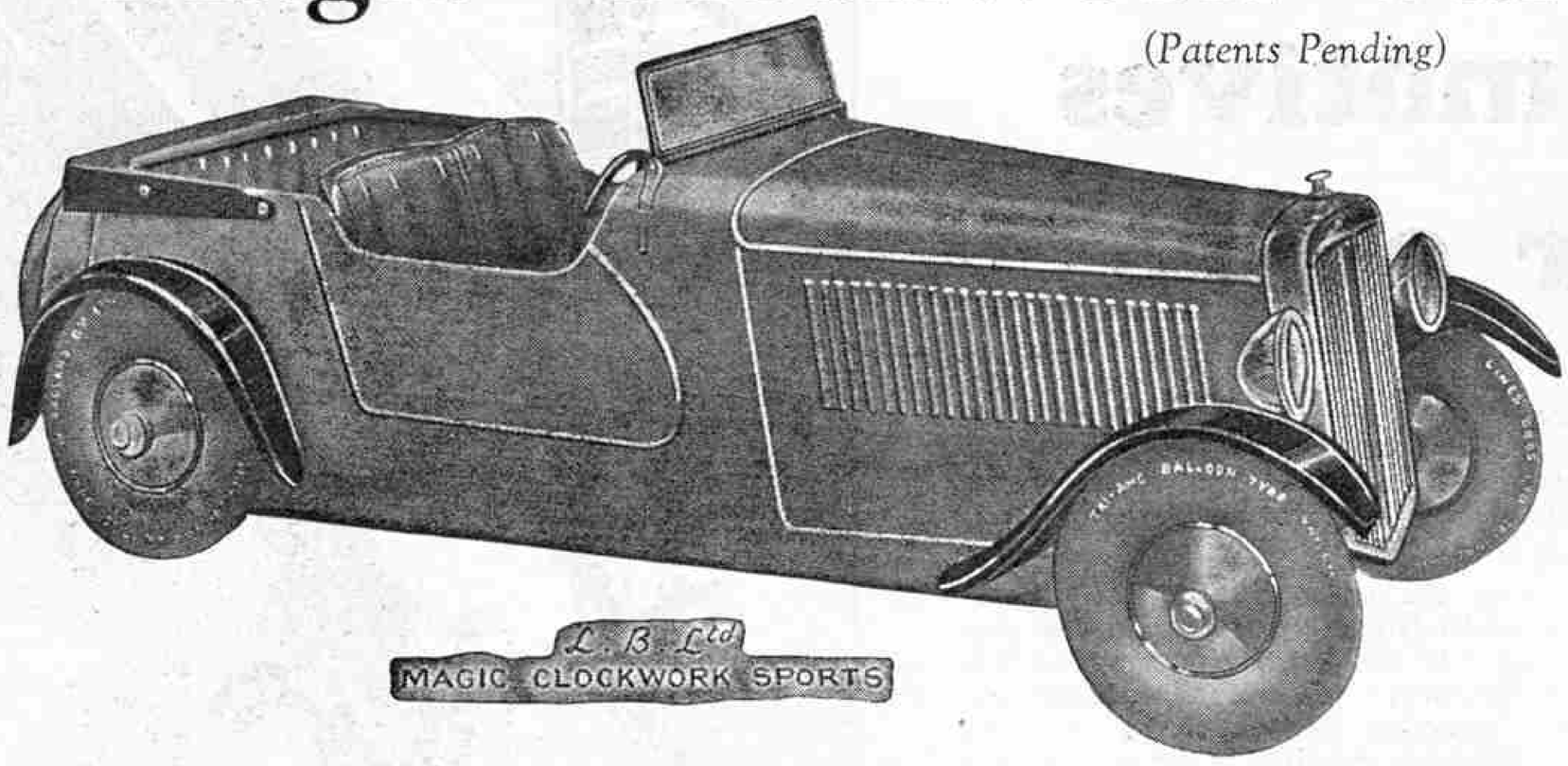
TRI-ANG

'Magic' Clockwork Cars

L. BROS. LTD. LONDON BROS ENGLAND

Regd. Trade Mark

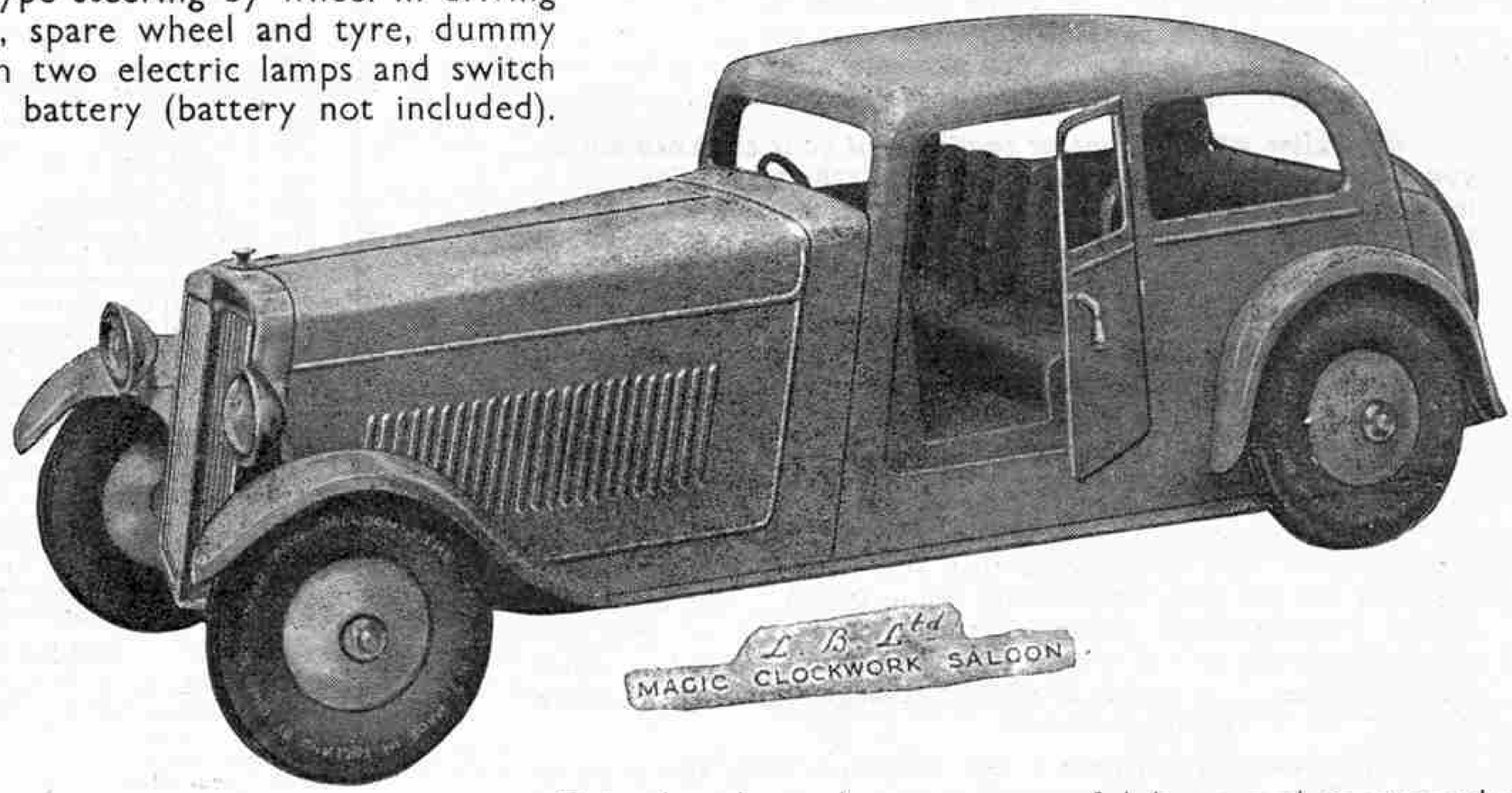
(Patents Pending)



16″ Overall
Weight 3½ lbs.

A scale model of a powerful four-seater modern sports car. Strong steel body, adjustable celastoid windscreen. Two lamps. Strong clockwork motor with levers to start and stop and fitted with governor and brake to prevent the wheels racing. Rubber balloon tyres and steel wheels. Motor type steering by wheel in driving seat. Four mudguards, spare wheel and tyre, dummy hood. Also made with two electric lamps and switch on dashboard for flash battery (battery not included).

Price 12′6 Net. **(Extra 2′6 for Electric Light)**



16″ Overall
Weight 3½ lbs.

This closed car has very graceful lines and is strongly made of steel. Designed in the latest low built style and driven by strong clockwork motor with lever to start and stop, fitted with patent governor and brake to prevent wheels racing. Rubber balloon tyres and steel wheels. Motor type steering by wheel at seat. Spare wheel and tyre, four mudguards. Also made with two electric lamps and switch on dashboard for flash battery (battery not included).

Price 12′6 Net. **(Extra 2′6 for Electric Light)**

BRITISH MADE
THROUGHOUT

Lines Bros. Ltd.

Tri-ang Works
Morden Road, LONDON

LINES BROS. LTD. LONDON BROS ENGLAND

Regd. Trade Mark

The Cycle Tyre you have been waiting for

The "SCOUT"

Made by the Dunlop Rubber Company so you know how good it must be. The "Scout" is an inexpensive tyre and really good value at its price. Ask your dealer to let you see it.

Always use

DUNLOP

TYRES, SADDLES AND ACCESSORIES

Retail Price
COVER TUBE
3/- 1/3

DUNLOP RUBBER CO. LTD.,
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Branches throughout the World.

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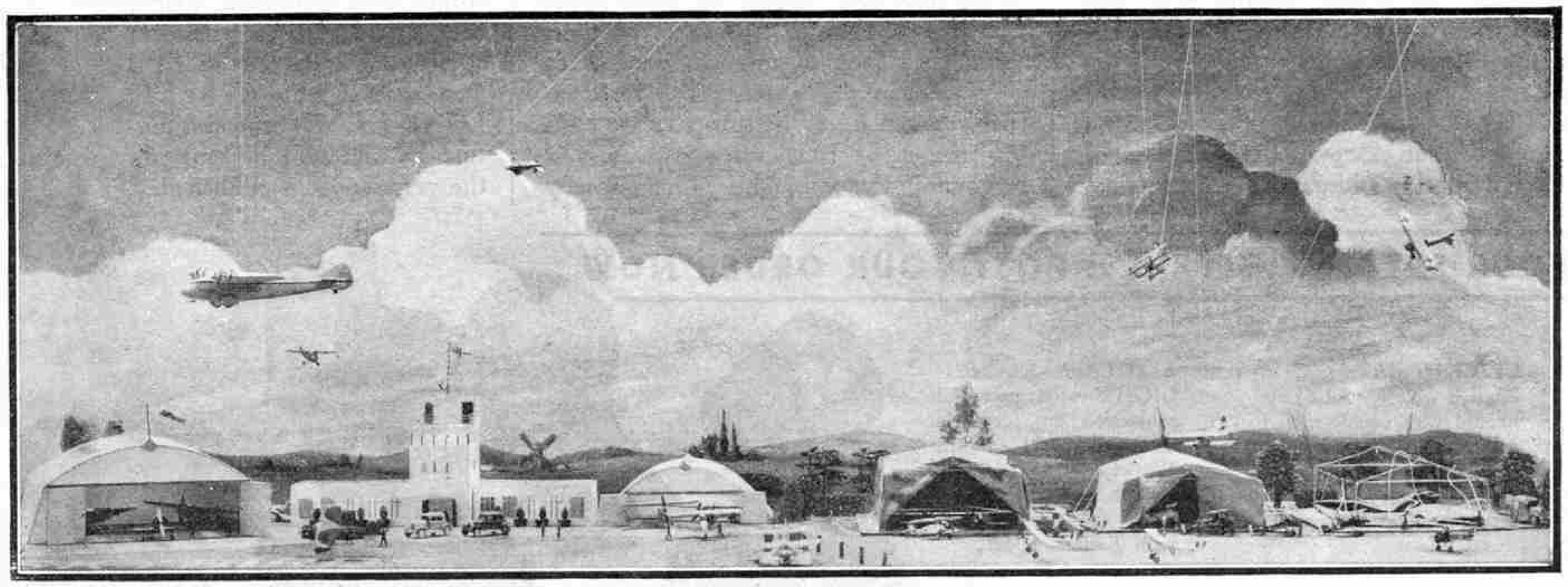


SKYBIRDS

MAKE A COMPLETE AERODROME OR WAR-TIME SCENE.
CONSTRUCTIVE 1/70th SCALE MODEL.
AEROPLANES AND ACCESSORIES FROM 1/6.

Fully illustrated "SKYBIRD" Book, 6d.

A New Series of constructive Waterline Scale Models **No. 1 H.M.S. "HOOD"**
Complete with swivelling metal 15-inch Barbettes and 5.5-inch Armoured Guns. Price **3/6**

For complete list and address of nearest agent, write :

A. J. Holladay & Co. Ltd., 3, Aldermanbury Avenue, London, E.C.2

Hamleys News

Estd. 1760. REGENT STREET

(SPECIAL MODELS AND GAMES SUPPLEMENT)

NUMBER 1 MAY 1933

LONDON'S MODEL AEROPLANE FLYING GROUND

Testing Model Boats

HOW TO CHOOSE A CRICKET BAT

Here is a tip for all you young aviators. Before you buy any model flying machine, try it out on the special aeroplane testing ground. You will find it on the ground floor at Hamleys in Regent Street, London. A skilled ground staff will help you fly your machine. Model aeroplane experts will help you choose the best. You can see the wonderful F.R.O.G aeroplanes, now including new models in exact colours of six famous foreign fighting and passenger air services and all the best model aeroplanes in the world.

BOAT POND IN REGENT STREET

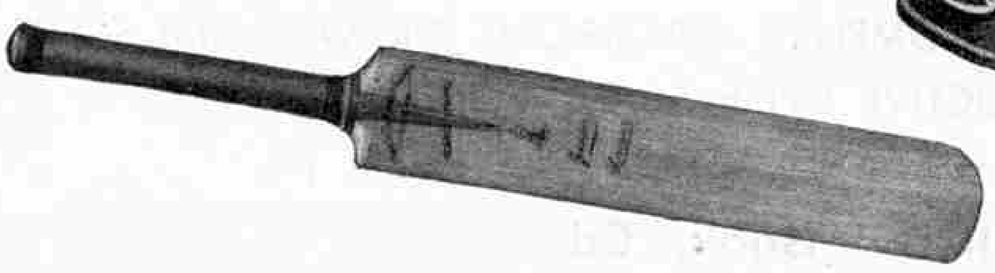
The model boating season has started. Brand new craft appear on every pond. But you will notice that some of these ships that look so fine do not go so very well in the water. The reason is that you can never be sure you are buying the right boat unless you test it thoroughly beforehand. That is why the most successful model yachtsmen get their boats from Hamleys where there is a pond on which they can try them out. Also, of course, Hamleys' boats are the very finest you can get.

WHO'LL MAKE TOP SCORE?

Be careful how you choose a cricket bat this year. A bat too small cramps you. A bat too big or too heavy makes your strokes too slow. It wants to be springy but not too "whippy." Try a few at Hamleys before you make your choice. There are hundreds to choose from and pads, balls, stumps, gloves, everything for the cricketer and sportsman. About Whitsun Hamleys' new Summer illustrated list of Summer games will be ready. It will be full of ideas for holiday fun, bathing stunts and Summer sports. Send a card with your name to HAMLEY BROS. LTD., 200 REGENT STREET, LONDON, W.1. and this picture booklet will be sent you the very day it is published.

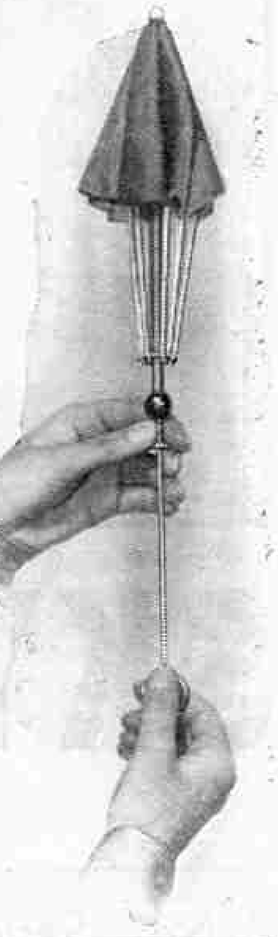
FOUR SPECIAL OFFERS — POST YOUR ORDER NOW

CRICKET BATS made of English willow. Solid cane handle with double rubber insertion. Complete with red rubber grip. Size 3 . . . **5/-**, Size 4 . . . **5/6**, Size 5 . **6/-** Postage 9d.



ELECTRIC SEARCHLIGHT with powerful projection lens, ideal for use with model aircraft. Worked by an ordinary pocket lamp battery. Easily adjustable. Price with battery **5/6d.** Postage 9d.

STEREO "PUCK" CAMERA AND VIEWER. Fitted with supplementary lenses giving a range of from 3 feet to infinity. Takes standard roll films $3\frac{1}{2} \times 2\frac{1}{4}$. Special folding viewer makes snaps stand out as in real life. Price **25/-**. (Post free).



STOP PRESS NEWS

RING-A-STICK	CATCH-A-BALL	THE DIABOLOTIN	SKI-HI Glider Parachute
For great fun and skill. **1/-** each. Postage 3d.	A new type Cup and Ball Game. **1/-** each. Postage 3d.	The game of the fifteen numbers —latest novelty from Paris. **2/-** each. Postage 3d.	*illustrated above* Complete with Launching Gun **1/-** Postage 3d.

FOR LATEST CRAZES Hamleys 200 REGENT STREET, LONDON, W.1

"LET'S SEND FOR THE CONSULTING EXPERT"

A NEW BASSETT-LOWKE SERVICE

When things are not running quite smoothly on your line—if your crack express does not run "to time"—if your switching or signalling apparatus needs an overhaul . . . . . send for Bassett-Lowke's Travelling Model Railway Expert. His services are free.

This is the first time such a unique service has been available. Even if your railway is not a BASSETT-LOWKE a line from you will bring this experienced engineer to your door.

His services are entirely free. All we ask you to do in return is to pay his third class return railway fare. You will be prouder still of your rolling stock and equipment after you have called in the services of our travelling consultant. Get acquainted with him at once.

If within 50 miles of London, our London Manager will arrange his service for you. If near Manchester, write to our Manager there. If you need further information, write to Northampton direct.

BASSETT-LOWKE LTD.

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NORTHAMPTON

Manchester Branch—
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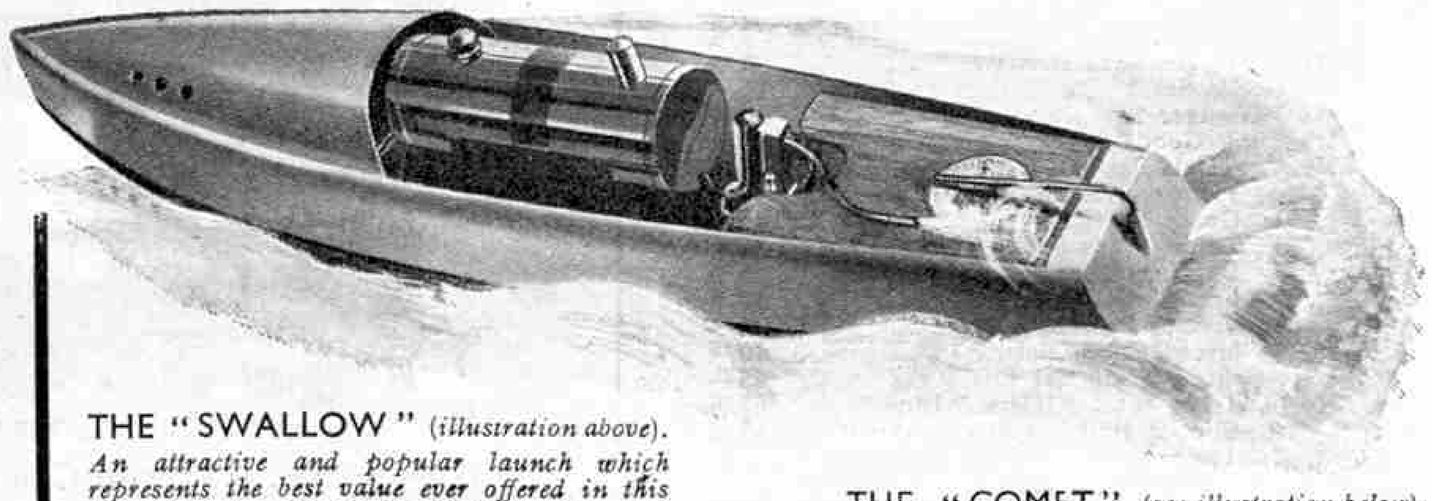
WRITE FOR THESE ILLUSTRATED BOOKLETS

Packed with information. Written by engineers. Book "A 17" is all about Model Railways and accessories. Book "B 17" describes Model Engines and accessories. Complete details of Model Yachts, Motor Boats, etc., are given in Book "S 17."

6D. EACH
Post Free
(As Illustrated)

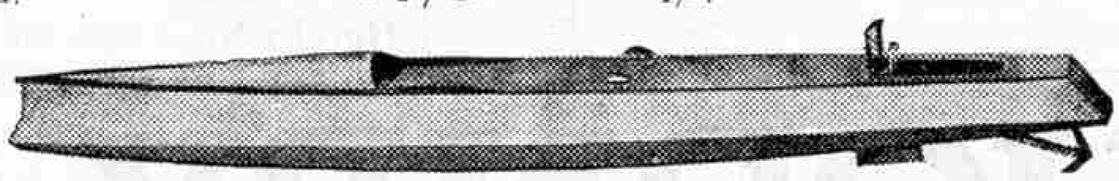
SPEED-SPEED-SPEED

Boys! Bowman have designed these models specially for you—to give you Speed—to make you winner of all the races you have with your chums. Watch these Bowman boats speed across the pond. Watch these aeroplanes soar to great heights at terrific speeds. It's the design that does it—minimises the resistance of wind and water—gives the powerful engine more power. Read about these models now—and look at the low prices.



THE "SWALLOW" *(illustration above).*
An attractive and popular launch which represents the best value ever offered in this type of boat. Steams for 20 minutes on one filling. Patent wood hull. Length 20". Beam, 3½". Bowman Engine, ¾" stroke × ⅝" bore. Polished brass boiler, 4½" × 1½", with safety valve and overflow tap. Safety type lamp for methylated spirit. With filler and instructions in wood box. Postage U.K. 9d. **17/6**

THE "COMET" *(see illustration below).*
Patent wood hull and aluminium spray hood. Length, 30". Beam, 3½". Polished birch deck, tongued to represent boards, new high speed, long running clockwork motor and starting lever. Polished cellulose finish. In strong wood box. Postage 1/-. **20/-**



THE "RANGER" AEROPLANE

Span 24". Length, 24½". Propeller, 9½". Flies 650 feet. Best proofed silk covered planes. Shock proof chassis—aluminium wheels.

Post free **4/6**

Other Models:
THE VORTEX **8/6**
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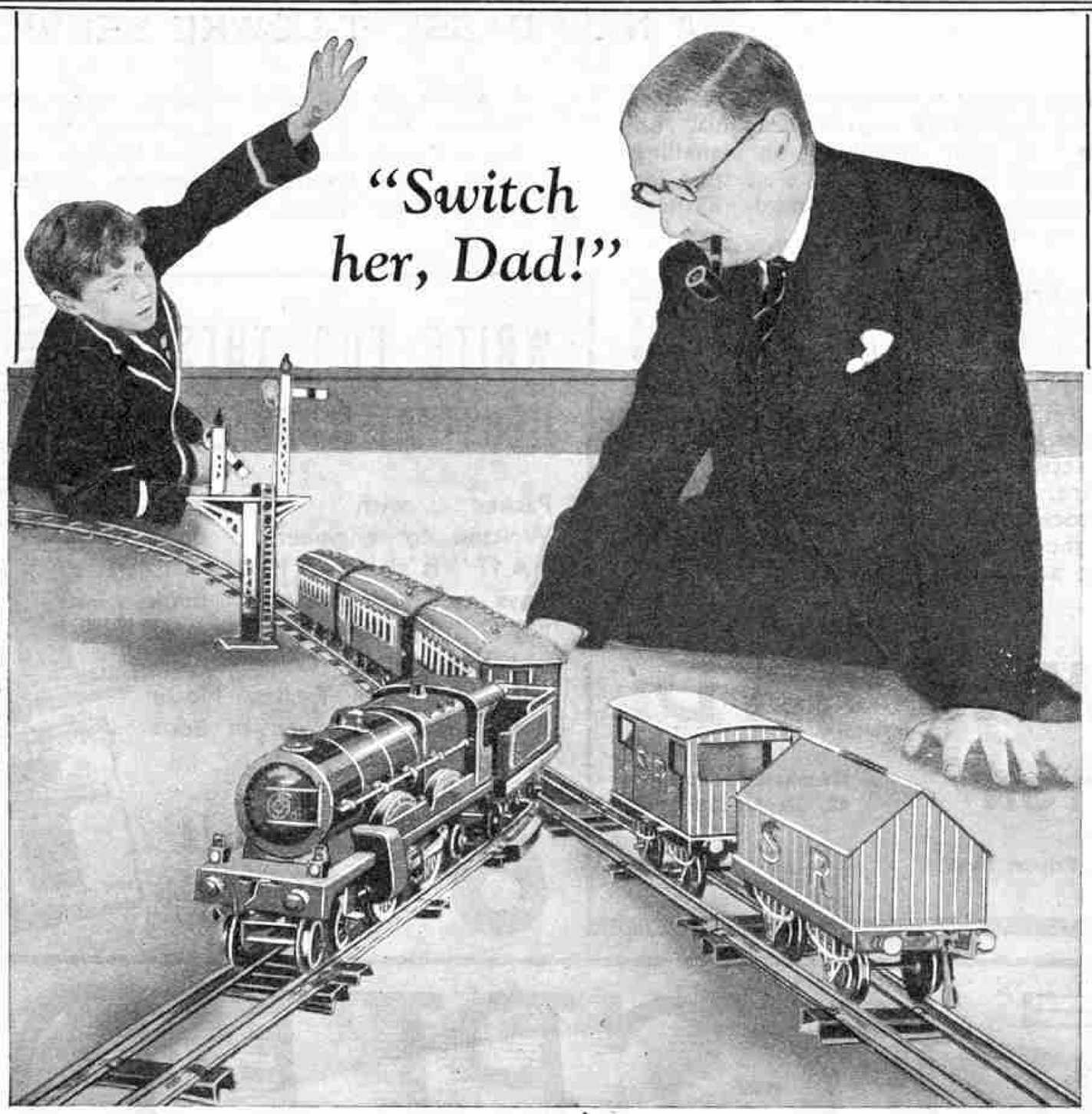
The marvellous rubber-driven "Whirlwind" Racer (not illustrated), 27" long for **1/3** is a really snappy speed boat.

BOWMAN MODELS

Send 3d. in stamps for complete Bowman Catalogue to Bowman Models, Dept. M.M., 19, Dereham, Norfolk.

POINTSMAN'S SKILL PREVENTS CRASH



Dad will be prepared for all kinds of commands when he has given you a Hornby Train and you have given him a job on the permanent way. The great game of railways is the most thrilling in the world—there will never be a single dull moment when you and Dad are managing your own line.

Hornby Trains are the finest trains that you can buy. The Locomotives are built for heavy loads and long runs; the Rolling Stock is strong, smooth-running and durable; the Accessories are realistic and correct in proportion, while every part is made of the finest material, by British craftsmen.

Tell Dad what you think of these fine models of modern engines and rolling stock. Tell him what every boy knows—that Hornby Trains are the best, strongest, and most efficient model trains in the world.

Ask your dealer for a complete illustrated price list of Hornby Trains, Rolling Stock and Accessories.

PRICES OF HORNBY TRAINS

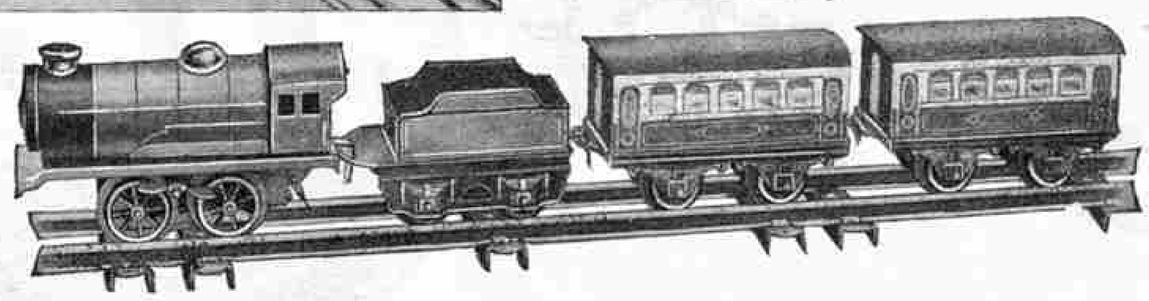
CLOCKWORK

M0 Goods Set	5/-
M0 Passenger Set	5/9
M1 Passenger Set	9/3
M1 Goods Set	10/-
M2 Passenger Set	10/9
M3 Tank Goods Set	15/-
No. 0 Goods Set	18/6
,, 0 Passenger Set	17/6
,, 1 Goods Set	25/-
,, 1 Tank Goods Set	25/-
,, 1 Passenger Set	28/6
,, 1 Special Goods Set	32/6
,, 1 Special Passenger Set	35/-
,, 2 Mixed Goods Set	40/-
Metropolitan Train Set C	45/-
No. 3C Train Set. Riviera "Blue" ...	62/6
,, 2 Special Pullman Set	67/6
,, 3C Train Sets. "Flying Scotsman," "Royal Scot," "Cornish Riviera" or "Golden Arrow"	67/6

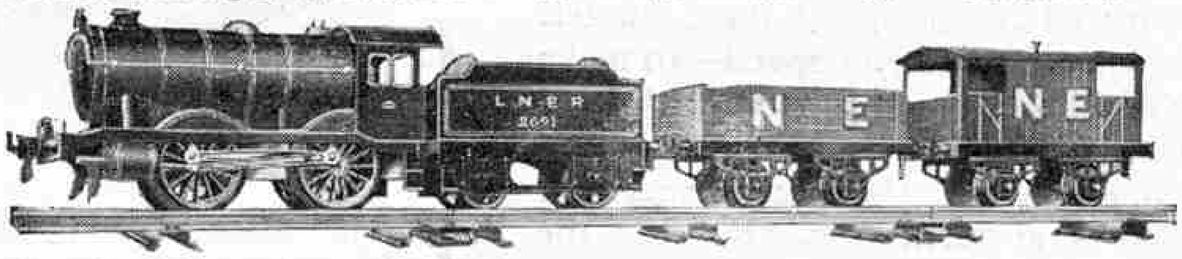
ELECTRIC

No. E3 Train Set. Riviera "Blue" (6-volt)	80/-
,, E3 Train Sets (6-volt). "Flying Scotsman," "Royal Scot," "Cornish Riviera" or "Golden Arrow"	85/-
Metropolitan Train Set, L.V. (6-volt) ...	85/-

A Selection of Hornby Train Sets



M0 Passenger Train Set ... ... Price 5/9



Hornby No. 1 Special Goods Train Set ... ... Price 32/6

Hornby No. 2 Special Pullman Train Set L.N.E.R. ... ... Price 67/6

HORNBY TRAINS

BRITISH AND GUARANTEED

Manufactured by MECCANO LTD., Binns Rd., LIVERPOOL 13

SUMMER

-the Season for Snaps,

SELO

FOR SNAPS
OF THE SEASON !

These are days for the out-o'-doors ; days to make the most of your camera ! Load up with SELO—the Fast Film—made to give the "professional touch" to the work of the amateur. Your snaps will be hailed as the best of the season !

THE FAST FILM

SELOCHROME
ROLL FILM
For use when days are dull or light is fading.

Made in England by
ILFORD LIMITED, ILFORD, LONDON.

Here's a
BEAUTY

You'll be proud to ride it !

A chap can have fine times on a bike—get about—see new places. But get the best bike while you're about it. Get a Raleigh. *You've* seen them and admired their slick appearance. Now get acquainted with their performance. They're beautifully balanced, tremendously strong and as light as can be. And however much you ride it, your Raleigh will always look "swell." Remind your folks, too, that the Raleigh is all-steel and guaranteed for ever ! Then they'll agree with you that the Raleigh's a good "buy."

RALEIGH
THE ALL-STEEL BICYCLE

Fitted with Dunlop Tyres, Brooks' Saddle and the best of everything. Specify the Sturmey-Archer 3-speed gear. 20/- extra.

£4 . 12 . 6
(or 12 monthly payments of 8/11.)

Send post card for free copy of "The Book of the Raleigh," and name and address of nearest dealer.

THE RALEIGH CYCLE CO. LTD., NOTTINGHAM
LONDON : 41, HOLBORN VIADUCT, E.C.1

Fit the Sturmey-Archer 3-speed gear—the gear that "makes cycling easy"

LOTT'S CHEMISTRY

Lott's Chemistry is great fun. You may not get much chance in the school " lab " to do as you like, but here are sets ready to hand that will give you endless pleasure. The larger sets provide apparatus for the preparation of Gases and other processes. An illustrated booklet of experiments, which can be performed with the contents of the respective box is contained in each set. The chemicals are packed in special lever lid cartons, and screw capped glass bottles to avoid deterioration. Spare supplies of the chemicals and apparatus can be obtained.

Box 2. Price 6/-

Obtainable from all leading Toy Dealers and Stores

Box 3. Price 10/6

BOX 2. This is an attractive set with Bunsen Burner, 22 chemicals, large and small test-tubes, tin dishes filter papers, litmus paper, magnesium ribbon, glass tubing, test-tube cleaning brush, and booklet of 80 Experiments. Price **6/-**

BOX 3. This set is a great advance on No. 2, as in addition to 30 chemicals, it contains a flask with rubber cork and delivery tube, porcelain crucible, glass funnel for filtering, and extra test-tubes and glass tubing. The book of 131 Experiments contains a number of unusually interesting reactions. The entire contents of the earlier sets are of course included in Box 3. As illustrated. Price **10/6**

BRITISH MADE

In addition to the two sets described there are other sizes at **3/6, 15/6, 21/-, 31/6** and **42/-**. These prices apply only in Great Britain and Northern Ireland. Obtainable in South Africa at Stuttaford & Co. Ltd., Capetown ; Canada at T. Eaton & Co., Toronto, H. Morgan & Co. Ltd., Montreal.

Write for Illustrated List to Dept. M.M.

LOTT'S BRICKS LTD., WATFORD, HERTS.

NONCLOG
Makes Cycling like Gliding

GRADE A (light) for ordinary use. 6d. per tin.

GRADE B (Heavy) for long distance riding and speed work. 7d. per tin

- Nonclog removes a frictional load which may account for 75% of your energy caused by wrong lubrication with ordinary cycle oils.
- Nonclog has greater viscosity and is retained longer in slack bearings.
- Because Nonclog has vastly greater lubricating properties, you can use LESS of it.
- Nonclog saves wear and tear . . . lubricates more efficiently at higher speeds and over longer distances. Nonclog saves energy and makes cycling more pleasurable. Ask for a tin of Nonclog to-day—the guaranteed cycle oil, and *" oil more and work less."*

NONCLOG
the CORRECT Cycle Lubricant

If you cannot obtain NONCLOG locally, write to:

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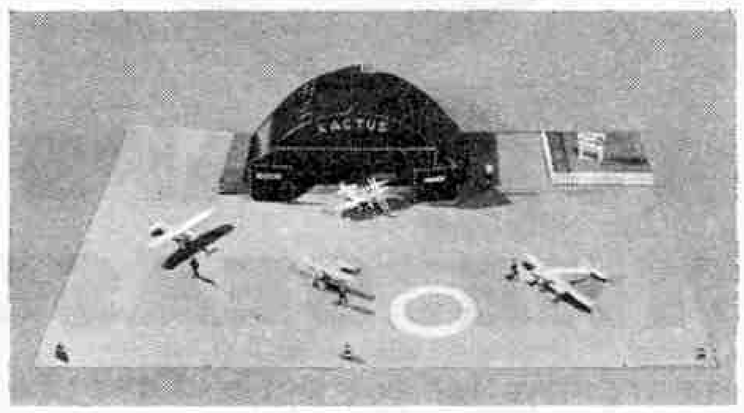

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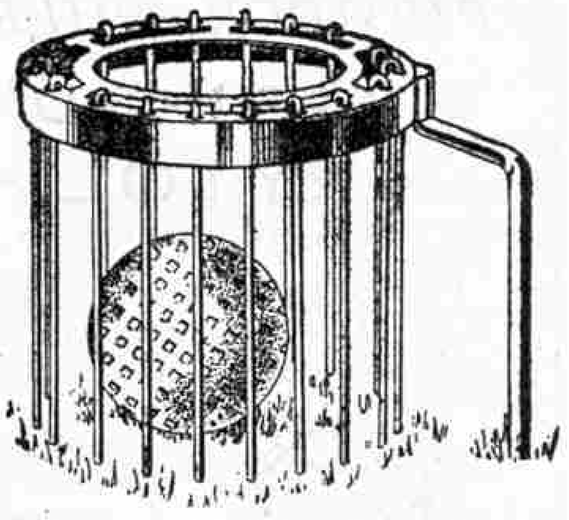

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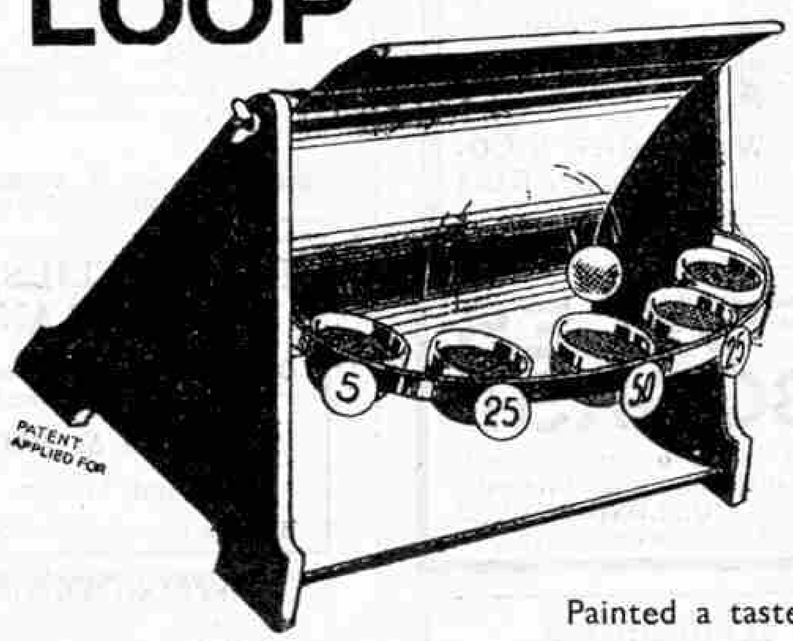

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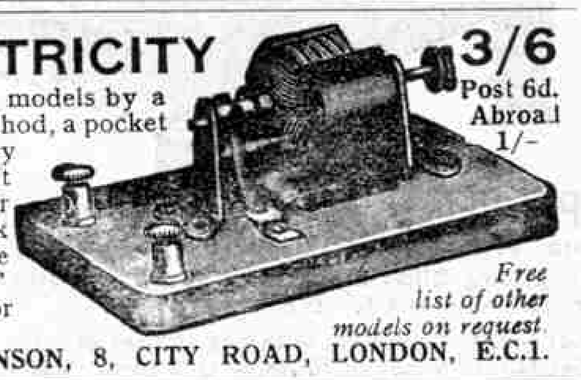

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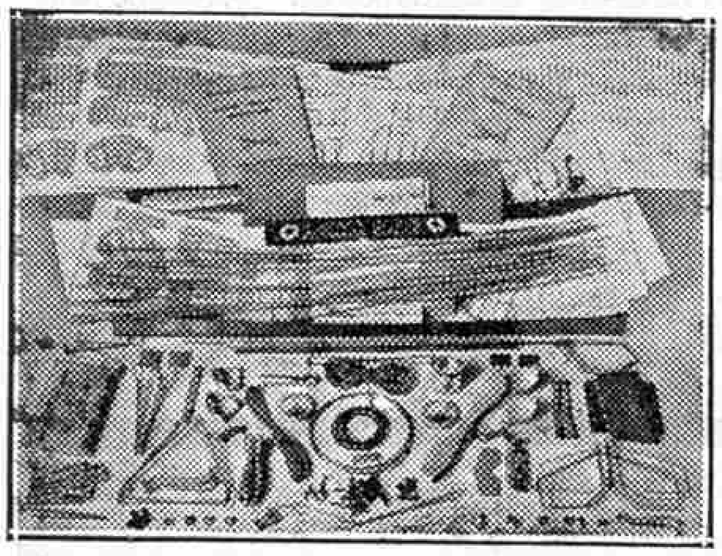

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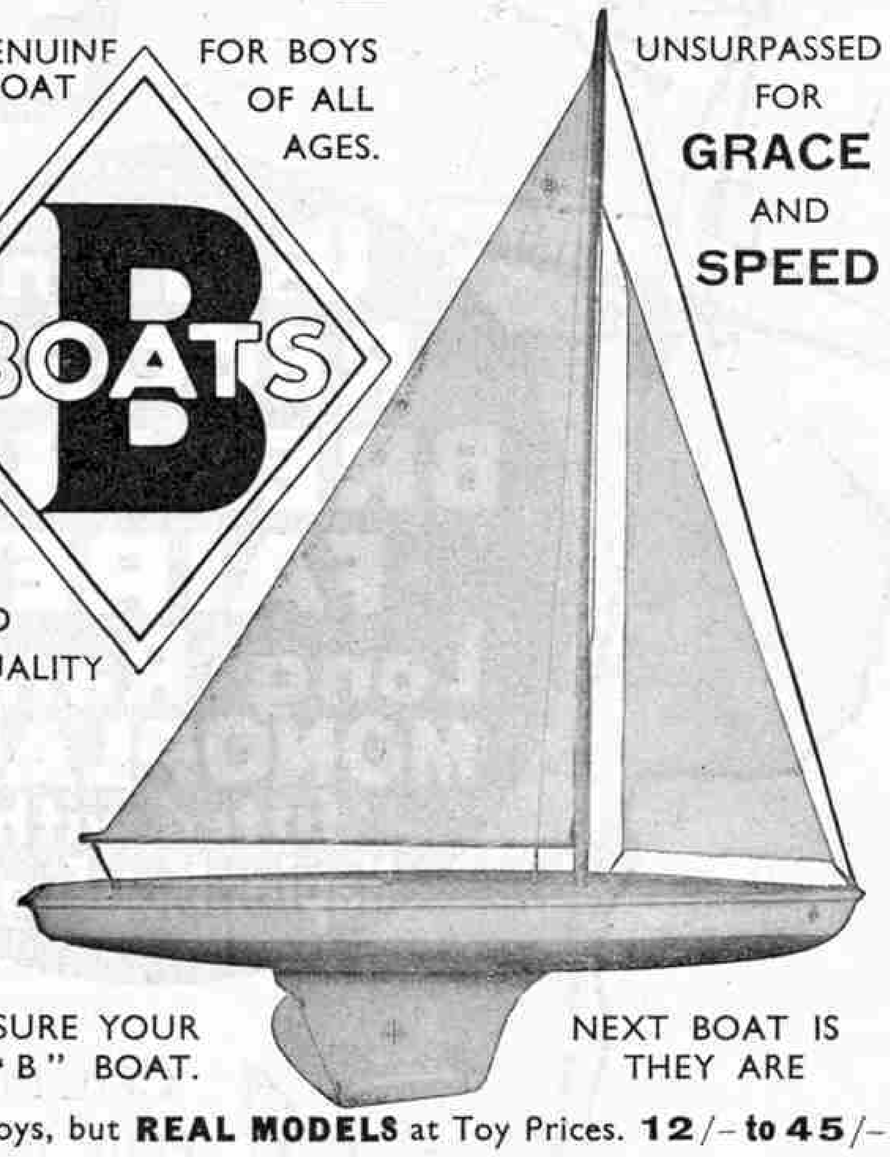

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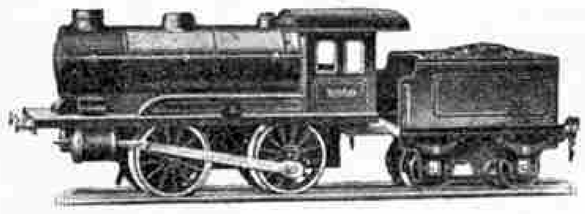

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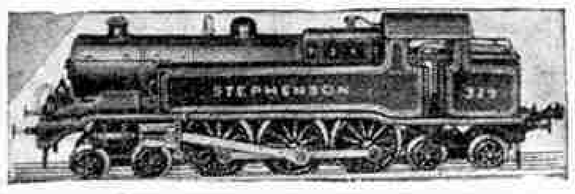

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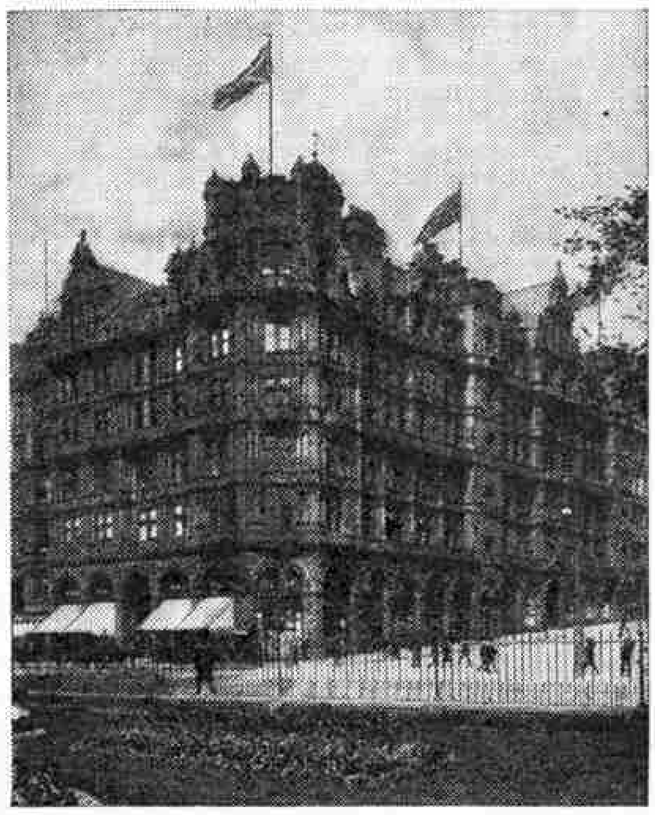

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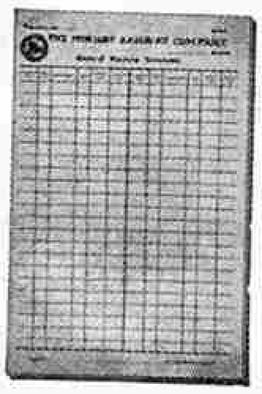

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Readers Overseas and in foreign countries may order the "*Meccano Magazine*" from regular Meccano dealers or direct from this office. The price and subscription rates are as above, except in the cases of Australia, where the price is 1/6 per copy (postage extra), and the subscription rates 8/- for six months and 16/- for 12 months (post free); Canada, where the price is 15c. per copy, and the subscription rates 75c. for six months, and $1.50 for 12 months (post paid).

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The Editor wishes to make known the fact that it is not necessary for any reader to pay more than the published price. Anyone who is being overcharged should lodge a complaint with the Meccano agent in his country or write direct to the Editor.

A Handy Cycle Repair Outfit

As the result of improvements in bicycle tyres, punctures are far less frequent than they used to be. They still occur, however, and therefore it is necessary to be prepared to tackle roadside repairs. Cycling readers will be interested to learn of a simple puncture repair outfit, known as the "Chemico" Outfit, that requires no rubber solution or French chalk, and ensures a permanent repair. This outfit, which costs only 4d., is marketed by the County Chemical Co. Ltd., Bradford Street, Birmingham 5, who will be glad to send details of the outfit, and of their other cycling specialities, to any reader who writes mentioning the "*M.M.*"

MECCANO

AEROPLANE CONSTRUCTOR OUTFITS

Boys, these Aeroplane Outfits are great! They enable you to build wonderful models of aeroplanes—the most realistic you ever saw.

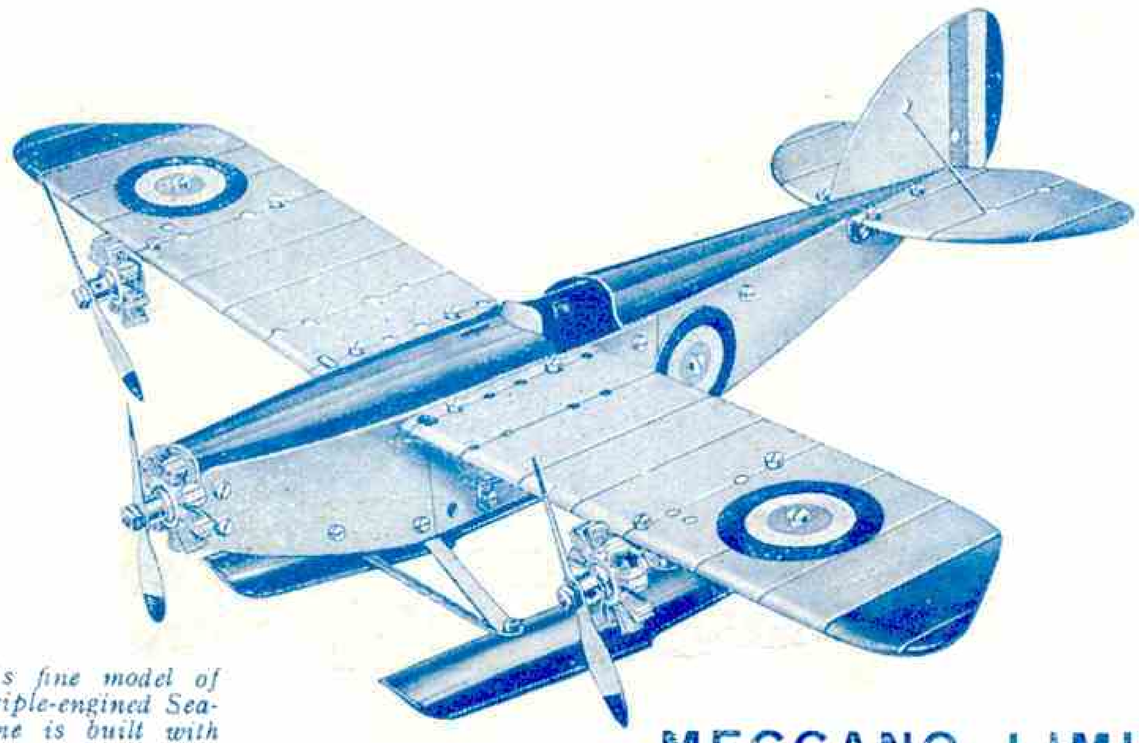
A beautifully illustrated Manual is included in each Outfit showing how to build a number of different types of machines, both monoplanes and biplanes. Many other splendid models may be built by varying the position of the parts, which are all interchangeable on the famous Meccano principle. The parts in the Nos. 1 and 2 Outfits can be used in conjunction with the standard Meccano parts.

If you want to know something about aeronautics the first step is to understand how aeroplanes are designed and constructed, so that you may be able to recognise at a glance the different types of machines. Buy an Outfit to-day!

AEROPLANE CONSTRUCTOR OUTFIT No. 0. The parts contained in this Outfit enable an interesting range of aeroplane models to be built, including low-wing monoplanes, seaplanes and standard light biplanes. All the parts are interchangeable. They are smaller than those in Outfits Nos. 1 and 2, and are not intended for use with these larger Outfits. Price 5/-

AEROPLANE CONSTRUCTOR OUTFIT No. 1. High and low wing monoplanes may be built with this splendid Outfit, while interesting model biplanes may also be constructed. The biplanes include models based on the single-seater fighter type of military aircraft, and on the popular light aeroplane. Price 9/-

AEROPLANE CONSTRUCTOR OUTFIT No. 2. This Outfit enables a much wider range of models to be built, including triple-engined monoplanes and biplanes, and a racing seaplane of the type that is used in the Schneider Trophy Contests. A particularly interesting model is that of a giant Italian bombing machine. Price 16/3

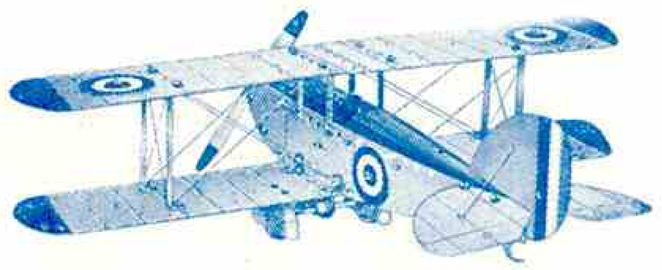


This fine model of a triple-engined Seaplane is built with Meccano Aeroplane Constructor Outfit No. 2.

MECCANO LIMITED
Binns Rd., Liverpool 13

Build your own model Aeroplanes!

The above illustration shows a model of a Biplane built with Meccano Aeroplane Constructor Outfit No. 0



This model of a Standard Light Biplane is based on the type that is generally used for civilian flying. It is a No. 1 Outfit model

Aeroplane Constructor Outfit No. 1

HORNBY SPEED BOATS

Hornby Speed Boat Week

A BIG EVENT FOR BOYS

From 20th to 27th of this month is Hornby Speed Boat Week. In all the best toy shops splendid displays of the 1933 Hornby Speed Boats will be on view and dealers are issuing special invitations for you to visit them.

During this special period every boy who purchases a Hornby Speed Boat will be enrolled in the Hornby Speed Boat Club and be presented with a beautifully enamelled badge of membership, free of charge.

Make a careful note of Hornby Speed Boat Week and tell all your friends about it.

20th to 27th May

Hornby Speed Boats are manufactured by
MECCANO LTD., BINNS ROAD, LIVERPOOL 13.

HORNBY CABIN CRUISER No. 5. "VIKING." PRICE 16/6

The perfect design and handsome appearance of Hornby Cabin Cruiser No. 5 make it a model of outstanding merit. It will travel over 500 feet on one winding. Finished in three different colour combinations—Red and Cream, Blue and White, and Jade Green and Ivory. Dimensions: Length, 16½ in. Beam, 3½ in.

HORNBY CABIN CRUISER No. 5. "VIKING." PRICE 16/6

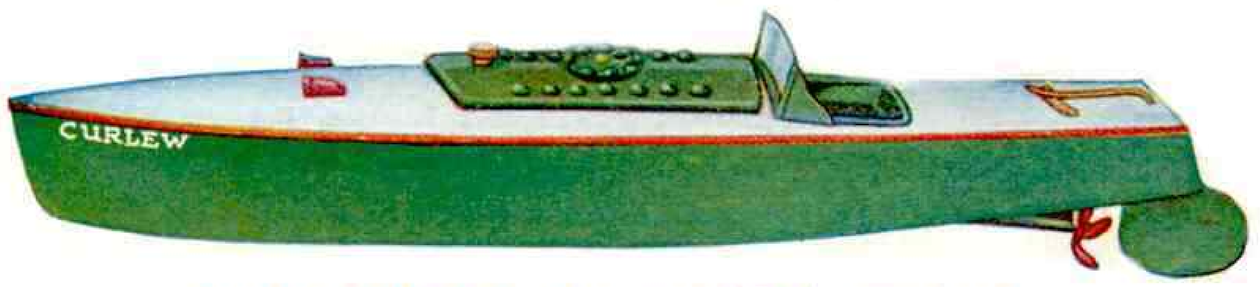
HORNBY LIMOUSINE BOAT No. 4. "VENTURE." PRICE 15/6

This realistic Hornby Limousine Boat No. 4 is a magnificent model. It will travel over 500 feet on one winding. Finished in three different colour combinations—Red and Cream, Blue and White, and Jade Green and Ivory. Dimensions: Length, 16½ in. Beam, 3½ in.

HORNBY LIMOUSINE BOAT No. 4. "VENTURE." PRICE 15/6

HORNBY SPEED BOAT No. 3. PRICE 12/6

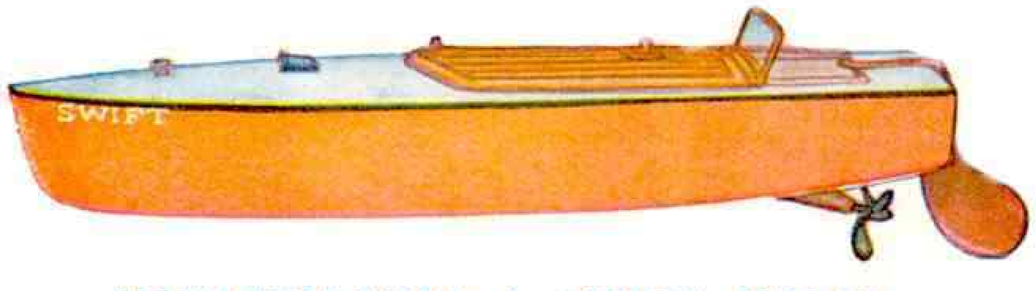
Hornby Speed Boat No. 3, introduced in 1932, has already established itself as a great favourite. It will travel over 500 feet on one winding. Available with three different names and in three different colour combinations, as follows:—"Condor" (Red and Cream), "Gannet" (Blue and White), "Curlew" (Green and Ivory). Dimensions: Length, 16½ in. Beam, 3½ in.



HORNBY SPEED BOAT No. 3. "CURLEW." PRICE 12/6

HORNBY SPEED BOAT No. 2. "SWIFT." PRICE 7/6

The exceptionally fine performance of Hornby Speed Boat No. 2 makes it one of the most popular of the Hornby models. It will travel over 300 feet on one winding. Finished in three different colour combinations—Red and Cream, Blue and White, and Yellow and White. Dimensions: Length, 12½ in. Beam, 3 in.



HORNBY SPEED BOAT No. 2. "SWIFT." PRICE 7/6

HORNBY SPEED BOAT No. 1. "MARTIN." PRICE 5/-

The Hornby Speed Boat No. 1 is a very efficient model, measuring 8½ in. in length and 2⅞ in. in beam. It will travel over 160 feet on one winding. Finished in three different colour combinations—Red and Yellow, Blue and White, and Orange and Green.

HORNBY SPEED BOAT No. 1. "MARTIN." PRICE 5/-

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